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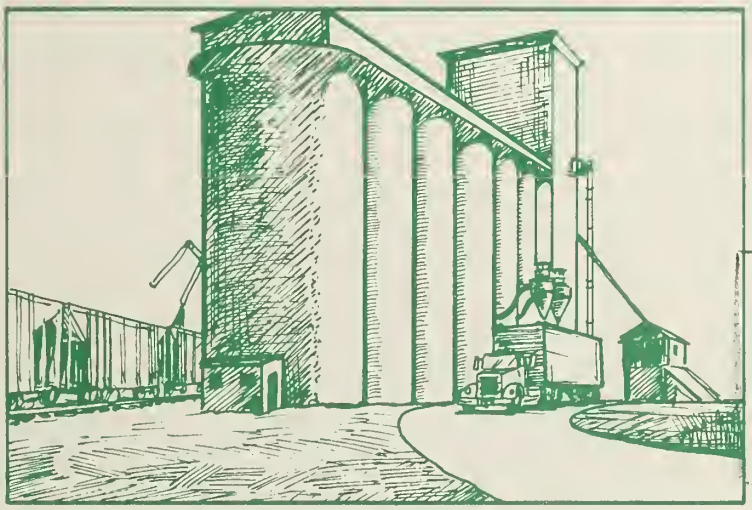
# PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON TRANSPORTATION FOR AGRICULTURE AND RURAL AMERICA



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**November 15 – 17, 1976 New Orleans, Louisiana**

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Symposium Chairman: Dr. Kenneth L. Casavant, Associate Professor
Washington State University, Pullman, Washington

16. Abstract

There is growing concern about the appropriateness of national and state transportation planning, policies, and funding arrangements for maintaining an efficient and equitable transportation system in rural America. Research sponsors need to know the state of knowledge in the area. The Offices of Rural Transportation Policy and University Research of the U. S. Department of Transportation; the Economic Research and Cooperative State Research Services of the U. S. Department of Agriculture; the State Agricultural Experiment Stations; the Farm Foundation; and the Upper Great Plains Transportation Institute agreed to sponsor jointly a three-day symposium on Transportation for Agriculture and Rural America to discuss research and research needs. The Symposium, held in New Orleans, Louisiana, on November 15, 16, and 17, 1976, was well attended with a broad cross section of public and private interests represented.

Symposium sessions were held on the following topics: Transportation of Agricultural Commodities for International Trade; Impacts of Transportation Regulation on Agriculture; People, Commodity and Service Transport in Rural America; Economics of Freight Transportation in Low Density Rural Areas; and Impacts on Rural Transportation from Changes in the Energy Situation and Transportation Policies.

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# Proceedings of the National Symposium on Transportation for Agriculture and Rural America

November 15–17, 1976

New Orleans, Louisiana

Edited by: John O. Gerald, *Principal Editor*
Kenneth L. Casavant
Robert J. Tosterud
William F. Brown

Jointly Sponsored By:

State Agricultural Experiment Stations. .

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Economic Research Service and
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U.S. Department of Agriculture. .

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Office of Rural Transportation Policy
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# FOREWORD

Widespread concern has developed over the adequacy of the rural transportation system to fulfill present and prospective demands of agriculture, other rural industries, and people who use rural areas for residential and recreational purposes. This concern is directed in part at the absolute adequacy, but perhaps in larger measure the concern is about trends in cost of rural transportation services in relation to trends in cost of urban transportation services, and other outside forces or events. Numerous events over the past several years caused these concerns to become acute, and several publicly supported research agencies proposed to undertake programs to improve the state of knowledge about rural transportation systems.

The idea to try to bring the various interested people together to discuss the state of knowledge regarding rural transportation arose in discussions between personnel of the Economic Research Service of the U.S. Department of Agriculture (USDA) and several State agricultural experiment stations, particularly those at the Washington and Mississippi State Universities. With the encouragement and support of the Farm Foundation, an initial Planning Committee was formed and developed preliminary plans. Other potentially interested agencies were then invited to participate in further planning and in sponsoring a national conference on the state of knowledge about, and needs for research on, planning, policy development and impact assessment for rural transportation.

Attendance at the Symposium was nearly ideal in terms of the consistency of the interests and competence of attendants with the purposes of the Symposium and the coverage planned. As the "Statistical Profile of Pre-Registrants" in the Appendix shows, by and large, attendants were from public and private organizations having a strong interest in rural research and/or action programs in transportation planning, policies, and/or impacts' assessment and alleviation.

In developing the program of the Symposium, the Planning Committee surveyed those organizations known to engage in research on the economics of rural transportation from time to time. Also, several prominent transportation economists were surveyed to determine if they knew of significant economic research projects or action programs on rural transportation underway outside of the usual rural research-sponsoring agencies. The responses received permitted the structuring of the overall program into five subject matter sessions, and nearly all persons identified as conducting relevant projects or programs were invited to make presentations. Representatives of several public agencies using research in administering transportation programs were also invited to react to the presentations.

Oversights in the program have come to the attention of the Planning Committee. For example, several attendants came from State Offices of Planning and State Departments of Transportation, but only two persons from such offices were on the program. Also, the American Trucking Associations among others have written about a perceived one-sidedness of the presentations in the session on the impacts of transportation regulation on agriculture. The Appendix contains copies of four letters that relate to this issue.

The editing of these Proceedings was primarily limited to that of making formats, footnotes, literature citations, etc., consistent. In instances where the editors did not understand the intent of the authors (or the transcript of discussion was unclear), the persons making the presentations have had the opportunity to make their views clear. The editing done was in no instance for the purpose of modifying the speakers' intents. Transcript material unrelated to the subject of the discussion was eliminated, and "Session Overviews" of the Moderators were amplified in one or two instances. Otherwise, the Proceedings faithfully reproduce the written or oral presentations of program participants and attendants.

Persons on the Planning Committee, Staff, and Editing Committee are identified in the Appendix. Without the work of these individuals and the other contributions of the sponsors, this Symposium would not have occurred.

For the Planning Committee
Kenneth L. Casavant, *Chairman*

For the Editing Committee
John O. Gerald, *Principal Editor*

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# EXECUTIVE SUMMARY

There is growing concern about the effectiveness of national and state transportation planning, policies, and funding arrangements for maintaining an efficient and equitable transportation system in rural America. Research sponsors need to know the state of knowledge in the area. The Offices of Rural Transportation Policy and University Research of the U.S. Department of Transportation; the Economic Research and Cooperative State Research Services of the U.S. Department of Agriculture; the State Agricultural Experiment Stations; the Farm Foundation; and the Upper Great Plains Transportation Institute agreed to sponsor jointly a three-day Symposium on Transportation for Agriculture and Rural America to discuss research and research needs. The Symposium, held in New Orleans, Louisiana, on November 15, 16, and 17, 1976, was well attended with a broad cross section of public and private interests represented.

## Organization of the Symposium

The Symposium was organized in six major sessions plus four keynote address sessions. Five of the major sessions were devoted to papers and discussion generally in the following areas:

Transportation of Agricultural Commodities for International Trade,

Impacts of Transportation Regulation on Agriculture,

People, Commodity and Service Transport in Rural America,

Economics of Freight Transportation in Low Density Rural Areas, and

Impacts on Rural Transportation from Changes in the Energy Situation and Transportation Policies.

The remaining major session was devoted to further discussion of the state of knowledge reflected by the papers and the needs for research, as well as statements of views, by the attendants.

Keynote addresses dealt with the state of knowledge about impacts flowing from regulatory policies and the organizational form of transportation planning agencies, and trends growing out of the level and source of investments in transportation systems.

## State of Knowledge and Research Needs

Published research on the influence of transportation on international trade was found to be very limited and largely theoretical in nature. Problems identified for future study included the questions as to whether improvements in domestic transportation for exported commodities result in improved farm returns or lower prices for foreign consumers and the equity of large-scale organization of local shipping facilities by the international trading companies.

Papers on the impacts on agriculture from transportation regulation dealt mostly with trucking. A large scale survey of truckers hauling exempt agricultural commodities interstate in 1974 suggested that the agricultural exemption has been accompanied by good trucking performance for agriculture. Also, studies showing some problems for rural areas in obtaining low cost, high quality service from regulated truckers were discussed.

Discussion of regulatory impacts raised few questions from attendants about the adequacy of these findings, but correspondence following the close of the Symposium revealed that not all attendants accepted the findings as valid. Papers, discussion and correspondence suggested that future research needs to examine economies of size in trucking and the quality and cost of trucking services now provided to rural America by both exempt and regulated trucking.

Extensive research on the relationships among people, commodity and service transport systems and the potentials for rural development was not found. Some but not all attendants felt that research on rural mobility and goods and services delivery systems should stress availability of high quality services in an equity context.

Research papers presented under the general topic of the economics of freight transportation in low density rural areas provided a full coverage of the area, from the measurement of the potential extent of the excess rail line capacity problem to the presentation of suggested methods on how capacity adjustment impacts may be estimated and coped with. However, no paper addressed itself to the question as to whether rural roads overall have excess or deficit capacity. Discussion revealed that attendants considered this an important area for further research, yet one for which analytical tools are reasonably well developed.

Analyses of changes in the energy situation suggest an adverse income effect on rural people from increased fuel prices, but attendants discussed whether alternate forms of mobility for most rural residents would ever be sufficiently energy efficient to displace privately operated vehicles. Also, few shippers in agricultural producing areas were found to have made any changes in transportation arrangements in response to changes in the energy situation.

Discussions about the adequacy and coverage of

publicly-sponsored research on transportation problems affecting agriculture and rural America revealed a mix of views. Divergence of views on the state of knowledge was probably greatest in the area about both impacts already accrued from transportation regulation, and impacts likely to accrue from future regulatory actions.

There seemed to be much less divergence of views about the quality of past research on rural freight transport planning and impact analysis. However, the area is by no means fully covered as yet, and there will likely be substantial expansion of research and/or planning activities in this area. A second area which discussion suggests may see significantly more publicly-sponsored research in the future is that of mobility and service delivery in rural areas.

While the Symposium was not designed to result in conclusions that some specific hypotheses were adequately supported, or that other specific hypotheses need further tests, the Symposium did provide much information useful to other researchers and research users. Hopefully, it will lead to an improved and expanded research program that can guide development of an adequate rural transportation system that is reasonable in cost for users and the public.

# Opening Keynote Session

Louis N. Wise, *Chairman*
Vice President for Agriculture, Forestry and Veterinary Medicine
Mississippi State University

DR. WISE: Good morning. My name is Louis Wise. I am from Mississippi State University.

New Orleans is a logical place to have a transportation meeting for agriculture and for rural development. New Orleans is a giant port. It is the port out of which a great deal of all of our agricultural production, our soybeans and our grains and other products, flow out into international trade, so I think it simply makes good sense to select New Orleans.

I think it also makes good sense to focus on the transportation problems of agriculture and rural America. Most of the things that you read or have to do with transportation have to do with urban areas, the problems that they are having with inner city transportation, but rural America has its problems as far as transportation is concerned also. Not only commodities, and all the moving to market with which we are all familiar but I think a part that is overlooked very often are the problems in transportation associated with the poor, with the elderly, and the young and so forth in rural America. I am delighted to see that the Federal Government, the Department of Transportation, is finally recognizing this and establishing a policy office along these lines.

I would like to compliment Ken Casavant and the program committee that planned this. You have a really terrific program. I am also impressed by the diversity of employment yet uniformity of interests of the people that are here and by the geographical dispersion of the folks that are attending this meeting.*

But, to get on with the program, we are going to have the opportunity of being welcomed to New Orleans and to Louisiana and to this part of the Deep South by Dr. Fred Wiegmann, and then our opening keynoter is Dr. John R. Meyer.

*Editor's Note: See Appendix for a statistical analysis of preregistrants.

**Louis Wise tells a football story while introducing Fred Wiegmann**

# Louisiana and New Orleans—An Early Gateway to Middle America: Welcome to New Orleans

Fred H. Wiegmann
Professor and Head, Department of Agricultural
Economics and Agribusiness, Louisiana State University

It is my pleasure to welcome you to New Orleans—to Louisiana—and to this Conference. We hope you will have both a productive meeting and a good time while you are here—and that you will come back, either on business or pleasure, or both.

Some of you have been to Louisiana before—but for some it may be the first time. For those for whom this is the first time I would like to extend a special welcome. You have come to a city and a state that has figured prominently in the history of this great nation.

Louisiana was explored in the early 1500's by the Spanish explorers Avar Cabeza deVaca and Hernando deSoto. In 1682 a French Canadian explorer, René Robert Cavalier de la Salle, came down the Mississippi from Canada. On April 7, 1682, by planting a large wooden cross in the ground at the mouth of the Mississippi, he took possession of the territory and named it "Louisiane" in honor of King Louis XIV of France.

It was not until 1699, however, that the French attempted to colonize the new country. Then another French Canadian, Pierre le Moyne d'Iberville, brought colonists directly from France. They explored the lower Mississippi and named one place "Baton Rouge" because of a large red pole found standing on the bank. Baton Rouge is now the capital of Louisiana. But Iberville finally settled on Dauphine Island in Mobile Bay.

In 1718 Iberville's brother, Jean Baptiste le Moyne Bienville, established a settlement on a bend of the Mississippi River. He named this new site the capital of Louisiana, "Nouvelle Orléans," in honor of Louis Phillipe, Duke of Orléans and Prince Regent of France. The site of that original French colony is the "Vieux Carre" or Old Square. A visit to New Orleans is unthinkable without a tour of the "Vieux Carre."

The French transferred Louisiana to Spain in 1762. Spain ceded Louisiana back to France by a secret treaty in 1800. On April 30, 1803 Napoleon sold the Louisiana territory to the United States for $15,000,000. The "Louisiana Purchase" encompassed all of middle America west of the Mississippi from Canada to the Gulf of Mexico—land that was later divided into 13 of the United States, including Minnesota on the North, Louisiana on the South, Montana, Colorado and Wyoming on the West.

One of those 13 states retained the name of Louisiana. Some of us are biased—perhaps unjustifiably so—but we think we live in the best part of the Louisiana Purchase—in a state that in many ways is as intriguing today as its history assures us it was in earlier times. We have a rich historical heritage of which we are justly proud. It comes from many nations—but particularly from Spain and France and the Indians of Louisiana. The French influence is predominant in South Louisiana and you see it all around you in New Orleans. There is French language and French names—Boudreaux, Barrilleaux, Benoit, Baudin, Cormier, Fontenot, Guidry, Dupré, Theriot, Primeaux, Richard, Martin Hebert. There are French "Cajun" customs, good French food and strong black coffee, if you choose to drink the right kind. We call our sluggish streams "Bayous"—our counties are called "parishes"—your roast suckling pig is our "Cochon-dulait" and our law comes from the Napoleonic Code. These characteristics give Louisiana a special charisma among the states—South Louisiana a unique charm—and New Orleans an atmosphere that can only be described as "piquante." (The dictionary says that means "engagingly provocative."

But, enough of our history and attributes—we also have some bad ones which I'll not mention. Let me speak—but very briefly—about the occasion of your visit with us—the problems of transportation as they relate to agriculture and rural America.

## TRANSPORTATION PROBLEM AREAS

Transportation is an extremely important part of the system that keeps our economy working, including the agricultural sector. Transportation is important to the housewife. In 1960 the transportation part of the marketing bill for farm foods amounted to $4.1 billion, or 9.2% of the total (1).* By 1970 that compo-

*Editor's note: Numbers in parentheses refer to literature citations at the end of each paper.

nent had decreased to 7.3% of the marketing bill. But in 1975 it was on the way up again, amounting to $8.5 billion and 8.2% of the total. That is greater than those portions of the food bill due to taxes, or depreciation, or rent, or corporate profits. Anything reasonable that can be done to turn that around again will help to lower the "cost of living" for all of us.

The oil embargo and subsequent increase in energy costs has added a new and unexpected dimension to the problems of moving people and goods around—in this country and throughout the world. According to a recent report by the Federal Energy Administration some 2.1% of the total energy consumed in the U.S. is accounted for by food and fiber sector transportation (2). With energy itself of great concern today this amounts to a problem within a problem.

Two years ago there were numerous stories on television and in other media on the problems concerning a lack of rail capacity to move grain to export terminals. This year the stories concern small barge loads and related inefficiencies and higher costs caused by an unusual and persistent low water level in the Mississippi river.

Transportation is important to foreign trade and particularly for agriculture. In fiscal 1974 our agricultural exports amounted to $22 billion and accounted for the production from 96 million acres of cropland, or one out of every three acres harvested. The thrust of broad American policy, both with respect to agricultural exports and political commitments abroad, is such as to suggest that a high level of exports will remain a major political objective for the foreseeable future.

World wide, transportation—and the distribution system of which it is a part—is an important cog in any plans to meet food needs in developing countries, either in an emergency or over a long period. We are all aware of the documentation of wasted effort and tonnage lost in trying to provide emergency food supplies to people in countries that could not get those supplies to the areas where they were needed. Of course, mismanagement and outright thievery has been part of that problem also. It remains a fact that any hope for alleviating human suffering in many countries—and helping them to help themselves—must include a major effort to improve their distribution systems.

On February 10, 1975 the Senate Committee on Agriculture and Forestry published a report of two studies—titled respectively, "Transportation in Rural America" (prepared by the Economic Research Service) and, "Meeting Rural Transportation Needs" (prepared by the National Area Development Institute). The two studies were made at the request of the Committee—and reflected a growing recognition by the Committee and others that all was not well in the transportation industry. Their concern was stimulated in part by two factors. First, the railcar shortage and strain created on domestic transportation by our increase in exports in 1972-74. Secondly, by the great increase in applications for rail abandonment in the early 1970's as compared with the 1960's. The Committee was particularly concerned about the potential severe hardships that can be created in rural communities by rail abandonment.

The Senate report took 350 pages of fine print. I don't propose to review them here. Some participant in your program probably has that in their agenda. But, beginning on page 207 of the report there is a discussion of research needed to further our understanding of this many faceted problem area and, hopefully, to provide some input to solutions.

In any event, it should be encouraging to this group that a Senate Committee has taken some action in this area and is encouraging us to do likewise. I think we may assume that this conference is a substantial beginning for increased professional attention, particularly among agricultural economists, to the problems of transportation as they impact on agriculture and rural America. I am sure the conference will be fruitful—the ideas generated worthwhile—and the implementation not long in coming. Judging from the program—the prognosis must be optimistic.

## CONCLUSION

It is fitting that this Symposium on Transportation For Agriculture and Rural America be held in Louisiana and in New Orleans. For the Mississippi River is one of the world's great avenues of commerce—and the Port of New Orleans is a major doorway to the markets of Europe, South America, Asia and Africa.

During the early 1700's New Orleans served as the gateway to middle America. Furs, hides, corn, meat and other products from the upper Mississippi, Western Great Lakes, and Canada, were floated down the Mississippi. The banks of this great river were often the "jumping off" spot for explorers and settlers as they pushed back the Western frontier of the new country.

But the importance of the Mississippi has never been greater than it is today—with thousands of tons of raw and finished products moving North and South on its broad waters and those of its tributaries. The Port of New Orleans is the largest on the Gulf Coast. It is the nation's second port in total waterborne commerce and in the value of its foreign commerce. In waterborne commerce volume it is *third largest in the world*. For volume of grain exports—*it is the world's largest*.

As envisioned by the earliest explorers, this river and this port are serving an increasingly important role in the transportation picture of this country and of the world.

While you are here you may wish to tour the port. At the foot of Canal Street steamboats wait to take you on a 2½ hour sightseeing cruise around the harbor. It is a very informative, very relaxing and very enjoyable experience. Try to fit it into your schedule.

So, again—we welcome you to New Orleans. Savor the flavor of this exciting city. Visit the "Vieux Carre"—the original New Orleans. Most of the old buildings are still there—imagine what it was like 100 years ago—200 years ago. Roll some of those names around on your tongue—Bienville, Iberville, Carondelet, Dauphine, Tonti—they are the names of the founders of the city. Have some Gumbo Filé, Crawfish Bisque, frog legs, oysters Bienville, and other famous Creole cuisine.

New Orleans is known, particularly around Mardi Gras time, as the "city that Care forgot." So, you're in the right place—to have a good time—and a good meeting.

"LACHE PAS LA PATATE."

Translated, that means "don't let go of the potato."

### LITERATURE CITED


(1) U.S. Department of Agriculture, Economic Research Service, Agricultural Outlook. September 1976, p. 12.

(2) U.S. Federal Energy Administration, Office of Industrial Programs, Energy Use in the Food System. May 1976, p. IV–19.


# The Application of the Science and Art of Economics to the Solution of Transportation Problems


John R. Meyer
Professor of Economics
Harvard University


Professional economists, looking at the title of this paper and at recent legislative history, would be tempted to ask: What applications? Curiously, transportation policy is an issue on which a remarkable majority opinion would be found in professional economist ranks. For example, transportation deregulation, if put to a vote of the American Economic Association, would probably obtain an 80 percent plus vote in favor.

As impressive as that might be, however, it does not seem to have had much influence on the political process. Senators sometimes protest that the public shouldn't expect mere politicians to know what to do on subtle economic issues when the experts are so disagreed. Even though the experts are reasonably well agreed on transportation policy, however, little seems to have been done. Apparently, agreement is needed from a wider constituency! The final irony, of course, is this year's main event in transportation policy: after years of waiting, deregulation of sorts was finally sanctioned by Congress for the railroads, but then was almost immediately annulled, or at least postponed, by the Interstate Commerce Commission on grounds of railroad "dominance" in a remarkably wide sweep of markets. So, even when economic wisdom has finally been sustained on Capitol Hill, the bureaucratic process can bring it low!

At the same time as economists felt frustrated by all this, they were simultaneously being attacked from other quarters as having undue influence on transportation policy. Transportation economists have recently found themselves being accused by, among others, the American Association of Railroads and the Air Transportation Association, of being heard, as Keynes once described some predecessors, by:

> Practical men, who believe themselves to be quite exempt from any intellectual influences, [but who] are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler of a few years back.

So it is a very curious world in which one might discuss the "application of the art and science of economics to transportation problems." It is a world in which, on the one side, the professional economists involved would protest with a certain sense of frustration, and even perhaps a tiny whine, that their ideas have had almost no application. On the other hand, many practitioners within the industry insist that they have had entirely too much!

Which position is correct? Obviously, that's a very good question. To attempt an answer, let's look first at the historical record. Following that, let's

turn to the prospects for the future and how choice of research priorities might influence future applications of economic analysis to transportation problems.

## THE HISTORICAL RECORD

It is indeed a fascinating exercise to determine if, when, and where the science and/or art of economics may have had some impact on transportation policy. The only obvious way to make such an evaluation, it seems, would be to cite some of the more important basic findings and conclusions of transportation economics and then look at the responsiveness, if any, of public policy to these findings. Let us do that in three distinct modal sectors: intercity freight, intercity passenger and urban.

### Intercity Freight

As already suggested, economic analysis has apparently not had a pronounced influence on policies relating to the regulation of intercity freight transportation. The modern history of efforts in this area perhaps is best begun with President Kennedy's message on transportation policy of April, 1962. A major theme in that message was that there should be an equalizing of regulation between the different modes. In particular, a strong suggestion was made that the agricultural exemption enjoyed by barges and trucks should be extended to the railroads as well. That seemingly innocuous recommendation, that all modes be treated roughly evenhandedly, did not clear the legislative hurdle—in spite of the fact that a fairly important class of shippers generally supported the move. It is all the more striking, therefore, that when legislative sanction of deregulation recently came to the railroads in the form of the Four-R's Act,* it was considerably more generalized or liberal than that proposed by President Kennedy.

An interesting question is: Why did deregulation, when finally legislated for the railroads, take this more sweeping form (than even the most optimistic or hopeful might have expected 15 or so years ago)? Was it because of the continuing impact and influence of findings made by economists investigating transportation matters? To some extent, I suppose, this was a consideration. However, the eventual legislative "triumph" was almost surely attributable to two other facts which have little to do with economic analyses. The first, quite simply, was the continuing deterioration, through capital withdrawal, of the American railroad industry. By the time legislative relief came, many U.S. railroads were in such obviously poor condition that they were quite clearly doomed as private sector activities unless drastic remedies were undertaken. Furthermore, because of continuous undermaintenance and withdrawal of capital, most railroads were clearly not in condition to be a major competitive threat to other modes. Any doubts as to the limited competitive capabilities of the railroads were dispelled when the railroads ran into extreme difficulties (not all of their own making) moving export grain in 1973 and 1974. By 1976, most of the railroads in the Northeast and the Granger states were in such sad condition as to represent no threat to anybody, except possibly themselves.

The other factor that mandated legislative experimentation with some limited deregulation of railroads was almost surely double-digit inflation. Regulatory lag has always been a problem for common carriers. With OPEC and the double-digit inflation of 1974-1975, this regulatory lag became virtually unbearable. It is striking, in fact, how the other badly impacted regulated industries, such as the electric utilities, almost immediately achieved a regulatory accommodation in the form of the energy cost pass through. The railroads, common carrier trucks and airlines, by contrast, had to rely on more or less the same old procedures for seeking rate relief. Discretion to raise or decrease rates within bounds without recourse to the usual regulatory approval, the essence of the rail rate deregulation embodied in the Four-R's Act, is one obvious way of bequeathing to the railroads some of the same escapes from regulatory lag that electric utilities had already achieved. Furthermore, public objection to rate increases under such obviously inflationary circumstances might be expected to be less, since the motivation and justification was relatively obvious.

### Intercity Passenger

Almost surely the biggest policy change occurring in intercity public passenger policy in the past two decades has been the creation of AMTRAK. A substantial deregulation of airlines, if it were to come, would be the only possible event of equal significance.

It would be nice to report that it was the findings of economists that finally persuaded Congress and the public that: (1) intercity rail passenger travel in the United States was very expensive; (2) large subsidies were required if services were to be maintained; and (3) these subsidies could be rendered more rationally by direct recourse to the public purse rather than indirectly by higher charges to freight shippers, lower wages to railway workers, and reduced profits for railroad shareholders. Certainly, many economists made those arguments over the

*Editor's note: The Railroad Revitalization and Regulatory Reform Act of 1976 is often referred to as the Four-R's or Quad-R's Act.

**John Meyer gives keynote address**

years. But there were also many transportation economists who denied them. I can well remember how skeptically the findings by myself and some colleagues (M . J. Peck, Gerald Kraft, John Stenason, and others) were received when we said in 1956, using statistical methods to estimate the railroad passenger deficit for U.S. Class I Railroads, that this deficit might well be slightly greater than that estimated by the so-called full cost method then employed by the ICC. One reason for that skepticism was that much conventional wisdom in transportation economics at the time held that the ICC's full costs were irrelevant to assessing the costs to the railroads of passenger services; instead, short-run variable or marginal cost concepts should be employed. On certain methodological grounds the critics of the ICC's full cost methods were perhaps correct. However, as a true measure of the *avoidable* costs imposed by rail passenger services, the ICC's full cost estimates were probably not too far off the mark. Indeed, subsequent direct tests of the proposition, provided by actual abandonment of services by major segments of U.S. railroading, would suggest that if anything, the ICC's full cost measure was a bit low, just as our statistical estimates of some twenty years ago indicated.

The economists' prognosis thus was somewhat mixed when applied to intercity rail passenger service and therefore was of limited influence in determining actual events as they led up to the creation of AMTRAK. Again, the major factor prompting this important policy change was the simple fact that many U.S. railroads were in severe financial distress, and this distress seemed to be closely related to the extent to which a railroad was involved in the passenger business. Specifically, railroads in the Northeast and several operating in and around Chicago seemed to be most involved with potential, or actual bankruptcies. AMTRAK, in many ways, could be construed as a temporizing action which attempted to stave off the continued withdrawal of capital from private railroading in the Northeastern United States by stopping one of the more obvious and exorbitant cash drains on rail operations in that sector of the country.

A very real question also existed as to whether without AMTRAK rail passenger services could be sustained. Of course, discontinuance might not have been a disaster since bus service continued to improve as Interstate Highways were completed. Intercity airlines, moreover, developed new potentials, fed by the rapidly improving technology and economics of that industry. However, the Northeastern part of the U.S. was also the geographical sector where the best case could be made for retaining intercity rail services. Many airports in the Northeast were already crowded by the time AMTRAK was created, amidst signs that this crowding might grow in intensity and importance. Much the same could be said of many of the highways leading in and out of major cities in the Northeast, particularly during rush hours. Furthermore, a good deal of commerce, commuting and other living patterns were geared to the existence of intercity rail services in the Northeastern part of the country. Finally, the railroad unions, which had experienced an almost two-thirds attrition in their numbers during the postwar decades, were understandably reluctant to see a further attrition created by a complete and abrupt abandonment of rail passenger services. In short, then, it would seem that the short run realities, and pragmatic adaptations thereto, dictated the creation of AMTRAK rather than the impact of any economic analyses.

## Urban

Urban transportation provides the most stunning, and disquieting, test of the effectiveness of economic analysis on transportation policy. To the best of my knowledge, there have been no truly professional economic analyses of urban transportation that have arrived at any other conclusion than that new rail rapid transit systems are extremely expensive means of moving people about in American cities. Wohl, Kain, and I developed some cost analyses that first made this point approximately 15 years or so ago. Our numbers have been checked, rechecked, reworked and overworked by many analysts since

then; it seems safe to say that all subsequent analysis done by disinterested parties have arrived at about the same conclusions as we did.

Recent analyses, in fact, would also cast doubt on the proposition that rail rapid transit even conserves energy or helps alleviate air pollution. This is important since in recent years energy conservation and improvement of ambient air quality have displaced national defense as the ultimate justifications for otherwise dubious transportation policies. Rail rapid transit involves a great expenditure of energy for initial construction, particularly if done underground. To recoup this large expenditure of energy by subsequent energy savings requires that the typical passenger be moved on rail rapid transit with less energy than by predecessor modes. The bus, however, tends to be a relatively energy efficient means of moving people about urban areas, and the history of new rail rapid transit is that a very large percentage, usually at least 50 percent, are previously bus patrons. For this segment of rail rapid transit patronage, then, there is an actual energy loss involved in the modal displacement. Energy conservation from rail rapid transit therefore must rely upon savings effected by removing commuting drivers from their automobiles. Usually only a minority of rail rapid transit passengers drawn to new rail systems come from the ranks of auto drivers. Furthermore, if and when automobiles reach the 25 mile per gallon target now mandated by Congress, modern high speed and high acceleration rail rapid transit systems will actually use more energy per passenger mile than auto commutation. Meanwhile, an economist (Charles Lave of the University of California at Irvine) has calculated that even if automobiles remain at 14 miles per gallon on average, it would take several hundred years to recoup the initial energy invested in the BART system; on the same calculations, if and when the automobile achieves the mandated 25 miles per gallon target, energy is conserved by shutting down BART. Incidentally, these calculations make *no* allowance for the greater circuity or miles travelled that normally occurs when public transit supplants private.

As a means of reducing air pollution, the prospects of rail rapid transit are only slightly more heartening. This, of course, is hardly surprising given its slight or negative influence on energy consumption. Again, rail transit's impact on air pollution is limited by its limitations in attracting people away from the auto. The key to solving auto air pollution is reducing the auto's polluting emissions—as the Clean Air Act Amendments of 1970 recognized.

It would be nice to report that all these calculations by economists on the cost effectiveness and energy usefulness of rail rapid transit have had an impact on public policy. Unfortunately, there is little to suggest any such influence. Proposals are still being made to build new and fairly extensive rail rapid transit systems in several American cities. It still seems the politically "in" thing to do to praise the virtures of rail rapid transit. Furthermore, if and when the situation changes, it will almost surely be because of the harsh facts of substantial cost overruns and ridership shortfalls on major new systems, such as BART in the San Francisco area; METRO in and around Washington, D.C. and MARTA in the Atlanta area. Also providing some inhibitions are the financial difficulties of many major cities; some local public officials now seem to feel that large operating deficits from rail rapid transit systems may not always be helpful to local public finances.

I should add, by way of perspective, that economists have *not* universally concluded that all public transit is unduly expensive. In fact, several economists have written extensively about the possibilities of using buses, in express modes and with priority access to high performance highway facilities, as a means of immediately developing low cost, high performance public transit. Furthermore, economists have been in the forefront in pointing out that the ultimate solution of U.S. urban transportation problems resides in civilizing the American automobile. By this it is simply meant that with increasing congestion, air pollution, and rising energy costs, a sensible adaptation is for Americans to begin using an automobile that is more like the standard European car, that is, one which is smaller and engineered to closer tolerances. The rationalization of the American automobile is indeed beginning to happen, but not because economic analysis pointed out the virtues of doing so. Rather, it is rising energy prices, increasing dissatisfaction with high levels of air pollution and the other social costs created by automobiles that have created inexorable pressures for such rationalization.

In sum, economic analysis may have done a reasonably good job, perhaps a rather prescient one, in identifying the basic trends and forces at work in shaping and reshaping transportation choices and modal performance in the United States. The direct or immediate influence on public policy, though, has been remarkably slight. Usually, the facts have had to be underscored or developed, often at rather considerable cost, by actual misadventures of public policy. The major contribution of economic analyses has apparently been to act as an early warning system and to alert the more sensitive elements involved in public policy discussions to these issues a bit earlier than otherwise would have been the case. This has surely been useful but probably not crucial. The question therefore naturally arises whether we economists could have done better at this early identification chore? In essence, that requires identifying which issues are likely to be important in the near future. Thus the relevant contemporary question is: to which policy issues should transportation economics now be addressing itself? To this question I now turn.

## AGENDA FOR FUTURE RESEARCH

A discussion of research priorities in transport economics is perhaps best begun by assuming that the battle for deregulation, at least in an intellectual sense, has been won. In my, admittedly partisan, view, almost everyone recognizes today that regulation does not serve the interests of anyone well. For consumers and shippers regulation creates important inefficiencies in the production of transportation services. For many carriers, particularly railroads and airlines,regulation results in a return on equity that is lower than that of almost any other major private sector of the U.S. economy. For the general public, not only is there the inefficiency, but the low returns on capital have often driven investment and services out, even where seemingly still justified by identifiable demands.

Since regulation has been such a manifest failure, the natural question to ask is, why has it persisted so long? One simple and obvious answer is that like almost any bureaucratic process transportation creates its own entrenched interests: those who administer it; those who make presentations to those who administer it; those who, although not involved directly in the administrative process, nevertheless gain from manipulating that process for their own advantage, etc.

Some of the most important and entrenched opposition to reducing regulation, however, is not to be found in the bureaucratic process itself. Rather, it originates from *both* shippers and carriers, who believe that they derive special advantages from regulation. These privileges have evolved from what is the very heart of the regulatory process, so-called cross subsidization.

Cross subsidization like any tax scheme (and cross-subsidization is a tax scheme!) can create its own, rather artificial values. Specifically, some of the privileges or windfalls created by cross subsidization can be themselves capitalized. This capitalization, in turn, can lead to hardship if deregulation occurs. Thus, a suburbanite might have paid extra dollars to acquire a home on the premise that a certain standard of public transit service would be available between this home and his downtown job. Similarly, the owner of a country grain elevator may have most of his life savings invested in that elevator and see these as in jeopardy if service were to be suspended on a low-density rail branch line serving his location. Much the same can be said for some small-town factories dependent on such rail services, with the additional complication in such instances of workers being displaced and possibly forced to move to find gainful employment.

The irony in this is, of course, that cross subsidization can be a highly unstable state of affairs, particularly as the sources of the largesse approach bankruptcy. One of the surest predictions that one can make in economics is that the number of "losers" from cross subsidization will systematically erode over time so that the wherewithal to pay for the gains to the "winners" will be correspondingly reduced. In the circumstances, therefore, it is sometimes difficult to understand why quite so much opposition always exists to deregulation.

The explanation, of course, is that the number of winners may be shrinking but it is still not zero! Furthermore, even if one is among those ostensible gainers whose future benefits are in jeopardy or in doubt, the possibility always exists that some public treasury or another can be convinced to pick up the bill, when and if the private sources dry up. History also suggests that those who cherish such hopes are not necessarily engaging in wishful thinking.

An essential public policy issue, of course, is whether cross subsidy situations could be bought out, with some savings still left over for consumers and producers. Economists, unfortunately, have done a better job of identifying the efficiency losses attributable to regulation than of estimating the losses possibly imposed on some by deregulation. My own guess would be that the extent and likely scale of "inequitable" property losses or damages that might be incurred from a cessation of the present pattern of cross subsidization would be limited. However, it would be comforting if we had better documentation on this point.

Another closely related issue badly in need of more attention is that of the financial mechanisms underpinning the industry. One of the presumptions justifying much of the extension of transport regulation in the 1930's was that transportation was an essential but intrinsically unstable industry, especially vulnerable to economic recession or depression. This instability argument would seem to have been based on the observation that some transportation activities can be highly capital intensive, financially leveraged, and therefore vulnerable to sharp and adverse swings in net cash flows, if and when recession appears. Curiously, though, the Great Depression of the 1930's was marked by a strengthening of the regulation for those modes which are least capital intensive, trucking and barge. At any rate, these financial issues have been little investigated. What is a sensible capital structure for a railroad, airline, trucking company or barge line? What kind of betas or measures of risk seem representative for these industries? In light of these structural and risk determinations, what might be a good estimate of the cost of capital to these industries? How do these capital cost estimates compare with realized returns? Are they sufficient to keep capital in the industry?

Still another policy issue worthy of more analysis, by economists as well as by others, is the question of why it is that the public sector has such a mixed record of meeting, with any kind of reasonable efficiency, its stated targets or goals in transportation? This issue, of course, is one of increasing concern as

the scale and scope of the public involvement in transportation grows.

I say mixed record, incidentally, because the public sector certainly has performed or met many of its targets, albeit sometimes rather expensively. We have built a fine intercity highway system that does connect up at various state borders and has fetched the farmers out of the mud. We also have a Federal Aviation Agency that, in spite of some oversights and possible oversensitivity to industry interests, has created what is by many, if not most measures the safest and most extensive system of intercity public airline passenger transportation to be found anywhere in the world. The public sector has also in recent years evolved, admittedly amidst considerable political and legal trauma and less than painlessly, a "solution" that has kept the northeast railroads in operation; this has been done, moreover, while not fully precluding the possibility that these properties might someday be able to exist within the disciplines of the private market economy. Something of the same might be said, though with a good deal less hope of private sector viability, of intercity rail passenger transportation. Governments—state, local and federal—have also collaborated to keep urban public transportation in being, though often at a cost that is excessive relative to the potential benefits. Finally, but again at very great cost, government has created a strong, viable and efficient (at least in terms of direct operating costs) intercity inland waterway freight system.

Strikingly, though, in almost every one of these public achievements, a few partial exceptions aside, costs seem to have been more than they should have been. While some explanations can be offered in partial extenuation, the conclusion, nonetheless, seems inescapable that it almost always costs more to provide transportation in the public than in the private sector.

Why this should be so is not immediately obvious. Casual but extensive personal observation would suggest that the functionaries populating the public bureaucracies are normally at least as dedicated, conscientious and intelligent as those in equivalent private positions. Differences seem to reside not so much in the personal qualities of those involved as in the discipline or motivation that top management seems able to develop in the different circumstances.

Whatever the explanation, these differences in efficiency between the public and private sectors have been a strongly observable empirical regularity for some time. An attempt should be made to determine if this is an inalterable state of affairs. If it can't be altered, certain important conclusions for public policy follow. The most obvious would be that in a mixed-market economy such as ours functions should be moved from the private to the public sector only under duress and the very greatest necessity. Indeed, consideration should be given to possibly making some reverse moves. To illustrate, in many instances where we now use public ownership or straightforward public subsidy to achieve governmentally mandated transportation goals, consideration might be given to using more service contracts between government and private vendors, with the contract awards being determined by competitive bidding; certain segments of urban transportation and local airline service strike me as immediate prospects for such consideration. An obvious research priority would be to investigate these possibilities more thoroughly than they have been, with particular emphasis on determining their feasibility or practicality.

More research attention should also be given to the very basic question of whether incentives could be restructured so that some of the presently observable efficiency differences between the private and public sectors might be narrowed. That is, could incentive schemes be established for the public sector so that its functionaries would aspire to and achieve the same efficiency levels as those of the private sector? More concretely, are there better ways of administrating government subsidies so that they do not have as many perverse efficiency incentives as they do today?

A closely related issue in need of more research is the impact of regulation on managerial incentives for those private companies still doing business in regulated transportation. Specifically, we need to go well beyond the Averch-Johnson hypothesis. It seems entirely possible, indeed probable, that the whole process of regulation can result in a downward vicious spiral of proliferating adversities and deteriorating managerial qualities. One way, for example, regulators attempt to prevent escape of transportation companies from the clutches of cross subsidization is to adopt a very negative attitude toward technological change. The classic recent example is the ICC's refusal for many years to allow the Southern Railway to use large hopper cars, so-called "Big Johns," for moving grain. Of course, a few bad experiences with regulation snuffing out innovation can have a chilling effect on management recruitment. Intelligent young managers are not likely to be attracted to an industry wherein society erects special barriers to innovation. Overall, regulation favors legal skills and tends to inhibit marketing and entrepreneural activities, the consequence being an unfortunate managerial imbalance in the typical regulated enterprise. Thus, if regulation is to continue, are there ways of making it more congenial to enlisting a wider and better blend of managerial talents in transportation?

A final issue which must be included on any agenda for future research is that of better measuring the extent to which Americans really do seek more and greater mobility. This, in fact, is perhaps the most fundamental and troublesome of all the issues now facing transportation planners. Given recent congressional decisions concerning the funding of AMTRAK and major new rail transit systems for some medium-size U.S. cities, the working guess

would have to be that Americans continue to deem any improvement in mobility worth almost any price. Having made that observation, though, one might also wonder whether political thought hasn't been somewhat slow in adapting to the newer technological and demographic realities. Is mobility all that necessarily desirable or useful in a society approaching demographic stability? Or, with considerable excess capacity already available in several modes and networks, are further increases in capacity really that essential?

Without question, these issues about the value of greater mobility—most particularly, their induced secondary and tertiary effects—have not been given the thought they deserve. For example, one of the heartier empirical regularities of the urban transportation scene is the constancy of the average time required for commuter trips in American cities; this would suggest that much of the improvement in urban mobility achieved through better urban roads and other commutation facilities in recent years has been absorbed by putting increased distance between one's place of employment and one's place of residence. Whether this decongestion or decentralization of American cities is advantageous is quite debatable. A priori, a rather good argument could be made pro or con. The important point is that such a major social change has been happening without much public discussion of these pros and cons or serious research efforts to identify the relevant costs and benefits.

Rather similar comments apply to some other major shifts or modifications in mobility that have occurred in recent years. For example, the Interstate Highway System coupled with proliferation of automobile ownership almost surely has improved the accessibility or mobility of residents of many, if not most, small towns in America. However, this has not been without some offsets; for example, those in small towns who for one reason or another cannot or do not own or operate automobiles may have had their mobility reduced because some *public* passenger services (e.g. rail) are not as extensive as they once were. The interesting question then arises: Is the redistribution of mobility and access attendant upon the development of the interstate system all that desirable or should some countermeasures possibly have been taken to attenuate some of the redistributional aspects? Again, a quite researchable set of issues can be identified.

Until we really do have a much firmer determination of the true value people attach to improvements in mobility, we really will not have the facts essential for doing reasonably rational and intelligent long-range transportation planning. Of course, we also cannot afford the luxury of not doing any planning until these and other missing facts and analyses *might* become available. Until then, we in the research community should not only be busy filling the voids, but also be properly circumspect in our criticisms of policy makers who, somehow or another, must muddle through.

# Discussion of Keynote Address

DR. WISE: Thank you, Dr. Meyer. Since we have time, the floor is open for questions or comments on Dr. Meyer's remarks.

FROM THE FLOOR:* Dr. Meyer, in your speech you commented on the mixed record of public agencies. During the 60's particularly there was a calculated effort to move away from the public to the so-called quasi-public agencies, such as the post office and CONRAIL. The question is, does this form of cooperation rather than government ownership have anything to do with the results, like the Postal Service as opposed to the Post Office? Have you noticed any changes?

DR. MEYER: Well, let's take them up separately because I think they are entirely different cases.

The Postal Service is very different from CONRAIL and of course we have more history on it. The problems with the Postal Service, I would guess superficially without being all that expert on it, would be the difficulties of taking over a very complex bureaucracy with all kinds of historical problems that needed remedy. Clearly, it is going to take a long while to do it.

I guess I also would feel that the new management of the U.S. Postal Service has made some mistakes. They have also done some very good things. Where the balance resides remains to be determined.

Now, CONRAIL, we only have about six months' experience and it is much too early to tell how that will turn out. I would be rather more hopeful about its prospects. Maybe that is because I am more involved with it as one of its Directors. The first two quarters' results are in on CONRAIL and we have come in, on an unaudited basis at a deficit much smaller than that projected in the so-called final system plan developed by the U.S. Railway Association.

Now these two first quarters just happen to be the two middle quarters of the year which means you have a substantial seasonal adjustment because railroads usually have their worst earnings in the first

*Editor's Note: Persons asking questions from the floor during the opening session were not asked to identify themselves for the record.

quarter of the calendar year. So, I am not sure how well we are doing at CONRAIL, but the early returns do suggest we are doing fairly well and probably better than planned.

Of course, COMSAT, which started with a completely clean slate, provides still another interesting contrast. The big advantage of COMSAT was that it was dealing with a technology where demand was obviously expanding and the technology improving, with lots of attendant productivity gains. And with a clean slate, they didn't inherit many of the problems of the past.

I should also add that CONRAIL was advantaged over the U.S. Postal Service by the Four-R's Act and predecessor legislation building in deliberate rationalizations, a spinoff of much low-density branch lines, provisions for terminating labor with public monies used for this purpose, removal of the big passenger problem in the corridor and explicit provision for full compensation for the urban commuter services. So, CONRAIL really starts off with many more advantages than the Postal Service because the enabling legislation tried to eliminate much of the bad preceding history.

FROM THE FLOOR: I was wondering, in the last part of your speech when you were talking about what value we assign to mobility and whether at least in the urban situation it is not so much mobility that we are seeking in our suburbanization pattern but just more space and less noise in the suburbs. Therefore, the commuting patterns have changed accordingly, but it is not mobility that you are seeking.

DR. MEYER: It was mobility, though, that made it possible.

FROM THE FLOOR: That's right.

DR. MEYER: As I said, I was not trying to pass judgment on it. What I think you are suggesting is that it is not only better roads and better commuter facilities that have generated suburbanization. There have been basic demographics, income trends and other forces at work, such as decentralization of employment, which have also fed this development. Nevertheless, the striking thing is that a lot of the improvement in mobility has been used this way. Is this a good or is this a bad thing?

I could make an argument both pro and con. It is an interesting debate.

FROM THE FLOOR: I believe one of the reasons the Interstate Commerce Commission and some of the regulatory commissions were started was because of flagrant discriminations against certain shippers, particularly in agricultural areas. Do you feel that these carriers and their owners and operators are no longer inclined to try these discriminations if regulation is done away with?

DR. MEYER: Going back to the early Granger movement creating the ICC, there is, first of all, a question whether the ICC really did eliminate the discrimination. That is a hotly debated point by economic historians and many scholars. I tend to the view it probably did eliminate some of the more flagrant excesses; there is a lot to suggest that regulation became effective only when the railroads found it in their self-interest to make it effective.

But today it is a very different story. With the amount of competition from barges and from truckers, who are basically unregulated in the agricultural sector, I see very little danger of railroads exploiting the farmers unduly by having the same freedom. In fact, I think what would have happened with the extension of the agricultural exemption to the railroads is that the farmers would have had reduced rates. There might have been some seasonal patterns when exceptional demands were placed on the system—in other words, peak load prices—which in economic terms would justify higher rates and that might have occurred. But on balance, I think that extension of the agricultural exemption to railroads would have been in the interests of the agricultural sector.

FROM THE FLOOR: Dr. Meyer, you made a reference to the ICC's frustration with the Four-R's Act. I wonder if you could be more specific on that.

DR. MEYER: Well, there is a clause in there, I forget the exact terms but there are probably several people here who can describe it better than I can, which had to do with where the railroads could not exercise their "new found" rate freedom. A very early ICC decision after enactment made most of the relevant markets non-competitive and therefore the new law's provisions for deregulation became inoperative.

I feel in looking at that decision that the ICC was much too narrow and strict constructionist. I don't quite know how they define competition but it certainly doesn't agree with my definition.

FROM THE FLOOR: Is market dominance the key?

DR. MEYER: Market dominance is the key phrase, yes.

FROM THE FLOOR: Well, you have already brought out market dominance, and I will pass that over, but I would like to comment on this question about discrimination. I have been engaging with some Canadian associates in studying how the commercial freedom, which is very great in Canada, has worked out, and I can say in answer to his question about whether discrimination would continue under market freedom that you get from deregulation, the answer is yes, it will.

There is no prospect that I can see that the railroads can go, or should be forced under present circumstances, to cost based rates, eliminating all discrimination except on back hauls and other such cases. There will continue to be discrimination. The point is, though, that under competitive conditions, which is not just intermodal competition, it is market competition, it is import competition, it is substitution of places to ship from. Take, for example, the automobile industry. They can ship from California

into Vancouver instead of shipping from Detroit, and that has a powerful effect on what the railroads can do.

Under conditions of competition which are very sophisticated in transport and in railway transport, competition acts as that regulator. It restricts, it tends to restrict, discrimination to that which is still justified by the excess capacity and other conditions of the railways. I would add that in those ten years since the '67 act, the National Transportation Act of 1967, there have been until very recently only three Section 23 cases, and the most famous of these was the rapeseed case brought by the prairie provinces, and when you look into that you find out that the essence of that problem was the prorates which led rapeseed to be sent to central Canada, there to be put into rapeseed meal instead of it happening in the prairies. That is due to statutory regulation which fortunately in the United States we don't have.

DR. MEYER: I agree with everything you said but there is a semantics question there. There is a body of economic theory, I suppose Hirshleifer is one of the more outspoken on this, which would suggest that the term discrimination should be reserved for certain cases and differentiation used in others.

I am not sure, in many of these cases where we use the term rate discrimination in transportation, that it would really be that in the strict economic sense as defined by Hirshleifer and colleagues. I tend to think theirs is a good point. Take the empty backhaul, is it discriminatory to pass along some of that cost saving to the shipment going in that direction?

The basic point, of course, is that rate regulations induce all kinds of inefficiency. The patterns that we many times call discrimination are really cost justified differentiations, and if there is some continuing discrimination embedded in the system, is it of such importance as to require the whole panoply and distortions of the regulatory mechanism?

FROM THE FLOOR: Well, I think I would agree with that, but don't you agree that there will be different add-ons to the variable costs?

DR. MEYER: There will be different rates and add-ons, yes, but this gets to another point.

FROM THE FLOOR: And that is the essence of commodity discrimination, but I don't think it is serious. The point I am trying to make is that it hasn't been serious in Canada.

DR. MEYER: I agree with you, but let's make one other point while we have this one before the floor. If there aren't some rate increases in a positive direction, it is quite clear that railroads will not survive as private enterprises. Now maybe we don't want them to survive as private enterprises, but that is really the basic question we face. The fundamental railroad policy question today is, do we want to allow the railroad rate structure to drift upward to a level that will restore the attractiveness of railroad investment to the private investor community, or do we prefer to fill the void created by the present low rate structure by government subsidy.

Now it is quite clear, one should point out right away, that either way the consumer-taxpayer will pay more. Now the real question is, which way will cost him more. I suspect you can make a fairly good argument that he is likely to pay more if you go the subsidy route.

Then the next question is, if one makes that determination, does one still want to go the subsidy, tax-paying, route in lieu of the private sector route, because one likes the distributional or equity or other features of that route better than one likes the private route? Now that gets to be a very subjective evaluation indeed.

FROM THE FLOOR: Well, I can add one more thing to that. In the Province of Alberta, as some of you may know, they submitted a rather interesting provision called the equitable pricing policy, and what that constituted was a scheme of making all rates equal to variable costs and finding some other way, which probably you had in mind, to raise the fixed costs and capital costs. They did this, in my opinion, as a way of getting rates down and more related to distance without the capital-value factor that they have always complained of in shipments from central Canada to the prairies, industrial products in particular. They wanted to get them down so as to stimulate more manufacturing.

So, the provinces and the Ministry of Transport committee authorized a study, a very large study by R.L. Banks Associates of the U.S. and several other consulting firms. That report came out late last year or early this year and it showed that except in a very few cases the ratio of transport cost to the total value of the product to destination would be so small that even if they went to a variable cost rate standard, it wouldn't encourage very much industry to develop. And so I believe that whole scheme had been dropped like a hot potato.

DR. WISE: I am going to take the prerogative of the chairman to bring this particular session to a close. I want again to thank Dr. Meyer. It is obvious that he stimulated a lot of interest and hit on some sensitive points in the group here.

# Session A: Transportation of Agricultural Commodities for International Trade

Lowell D. Hill, *Moderator*
Professor of Agricultural Economics
University of Illinois

DR. LOWELL HILL: Before we start Session A, I would like to make one quick announcement. We invite you all to attend—*you all*, this note was written by a Southerner I can see—we invite *all of you* to attend a free transportation research information system on-line demonstration to be conducted today and tomorrow just outside this meeting room.

There will be an opportunity to learn about the information services that are available and being provided by this computerized system, and I think you will find it interesting and hopefully also useful. Stop by any time during the breaks or as you are coming and going during the rest of the day to look at this. The TRISNET people want the service to be more responsive to your professional needs and to have a more effective dissemination and retrieval system, and that requires that you participate and give some feedback to them for that.

Lynn Sander (seated) displays abilities of TRISNET to Mary Berglund, Floyd Gaibler and T. Q. Hutchinson

## OVERVIEW OF SESSION

Transportation plays a dominant role in international trade in agricultural products. It has received attention in theory from the time of Adam Smith and it also occupies a significant portion of the time devoted to management decisions from the country elevator all through the grain trade.

Low cost, large volume bulk shipments have made possible the increased productivity that is associated with inter-regional and inter-country specialization in production, but as this specialization increases, the demand for transportation services also increases and the entire system becomes more and more complex. This complexity takes several forms.

First, freight rates in international trade are difficult if not impossible for the economist to describe because of their volatility and rapid changes and their lack of uniformity. There is no ICC in the international bulk freight market.

Secondly, transportation often gets mixed up with international politics. Whose vessels are permitted to haul whose goods and what portion of total grain shipments must move on U.S. flag ships are political decisions that get mixed in with our international trade and transportation questions.

Thirdly, the system is complex because transportation logistics require coordination between many groups with different interests and goals. The longshoremen, the railroad unions, the ship owners, the grain shippers, the grain buyers and the consumers all have different views of how the world grain trade should be operated and to whose benefit. Each group places its own restrictions, economic as well as political, on the transactions. As a result, the efficiency of the entire system may be less than it would be otherwise. Researchers must find ways to integrate the influence of these diverse groups in seeking to improve efficiency.

Solutions to these and other transportation problems require a theoretical framework within which to evaluate alternatives. While economic theory has long recognized transportation variables in international trade, it has seldom provided applicable answers to the important problems of the transportation industry.

International transportation cannot be separated from domestic policies on transportation. The logistics of matching domestic grain flows with ocean transportation require integration of storage problems, storage policies, domestic transportation regulations and the scheduling of grain and ship arrivals. These domestic transportation policies influence the price levels, the flows to the market channels and the destinations of the grain.

For example, the introduction of unit train rates in the cornbelt lowered the cost of grain at the ports and shifted the grain flow from local processors to the export market and changed the competitive relationship between barge and rail transportation. If similar rates were introduced for soybeans, we would expect to see similar kinds of effects in prices and destinations. The unit train rates also provided an incentive for the subterminal elevator and it altered the role of the small country elevator in the Midwest.

The coordination problem in transportation of grain extends beyond the transportation logistics to the ownership of the grain, control over storage and movement and access to foreign markets. In recent years cooperatives have taken an increased interest in the export market and have sought to increase their role in international trade.

In many respects the transportation and coordination problems of cooperatives are the same as those of private firms, but cooperatives also have some unique problems. For example, they often find their flexibility is restricted by their responsibility to U.S. producers. This relationship of the cooperatives to producers provides some additional control over sources of supply but the lack of control through the rest of the market channels sometimes places limits on the cooperatives' access to export markets.

**Stan Thurston, Lowell Hill, Jim Jones (standing) and Mike Swanson discuss transportation and trade**

# The Relationship Between International Trade and Transportation: Theory and Developments[1]

James R. Jones
Assistant Professor of Agricultural Economics
University of Idaho

The importance of international trade to United States agriculture is well recognized today when nearly one out of every three acres in crop production finds its market overseas. Consequently, transportation considerations including international transportation developments are important research and policy issues from the standpoint that they affect significantly agriculture's ability to service overseas markets on a competitive basis. This paper will be concerned with international trade and transportation from the standpoint of surveying how their relationship has been viewed by economists in the past, what are some of the important developments today in the international transportation arena, and what are some of the approaches applicable to future research efforts in the area of international trade and transportation.

## RECEIVED INTERNATIONAL TRADE THEORY AND TRANSPORTATION

The first part of this paper reviews the historical position of transportation considerations in international trade theory literature. Economists have a tradition tracing back to Adam Smith of allocating a substantial portion of their attention to developing a theoretical framework to explain the role and reasons for the existence of international trade. Consequently, an extensive body of literature is available to researchers and policy analysts today on the subject of international trade. The question for this session is, does this body of received trade literature offer any insights to researchers concerned with transportation research as it applies to agricultural trade today and in the future? This is a logical question to raise but after one surveys the information received from this body of trade theory, one discovers that very modest attention has been given to the role of transportation by economists associated with international trade issues. In fact, the premise that will be developed in this paper is that transportation matters need to be investigated conceptually and empirically with regard to how they might fill a void in international trade research.

Returning to the development of international trade theory, world trade expanded to unprecedented proportions in the nineteenth century with England assuming the role of lead player. Concomitantly the classical English economists turned their attention to the subject of world trade. Specifically, Torrens, Ricardo, Mill, and others focused on the gains in trade deriving from specialization. Important points were scored for the cause of liberalizing England's international trade policy as a result of the articulation of the principles of comparative advantage and reciprocal trade during this era. These principles served then, and continue to serve now, as underpinnings for policy prescriptions to remove governmentally created barriers and distortions to international specialization and trade between regions and peoples separated by national boundaries. The abolishment of the so-called Corn Laws in England was a precedent to unilateral and multilateral efforts later to remove restrictions that impose constraints upon international specialization. The multinational trade negotiations in Geneva today are a continuation of efforts in this direction.

International trade theory historically has put considerable emphasis upon the issues of what goods a country will trade and at what relative prices, or terms of trade. Which goods a country exports and which it imports according to classical trade theory is dictated by the law of comparative advantage as first set forth, almost simultaneously, by Ricardo and Torrens.[2] This doctrine states simply that a country will specialize in production and export the product in which it has the greater comparative advantage or least comparative disadvantage and import the product in which its comparative advantage is least or comparative disadvantage is highest. While this notion is straightforward enough, it begs the question of what underlies or accounts for relative cost differences between countries. The standard answer provided by modern trade economists is taken from the Heckscher-Ohlin factor proportions theory that different goods require different intensities or ratios of factor inputs and different countries have different factor endowments.[3] Accordingly, wheat which requires considerable land inputs relative to labor and

capital, will be produced and exported by countries which have a relative abundance of land suitable to wheat production. The theory goes on to say that trade takes place and continues until relative price of commodities and factors of production, aside from transportation costs, are equalized between countries (factor price equalization theorem). The interesting part of this principle is that while transportation cost is acknowledged, it is so only in a passive manner.[4] As a matter of fact, in general equilibrium versions of trade theory, transportation considerations are abstracted entirely out of the analysis. Markets are treated as single points in space and transportation and other transfer costs are accordingly assumed to be zero.[5] Transport costs are not considered to be active determinants of the size and composition of international trade flows.

This treatment sets with considerable difficulty and particularly so with those affiliated with agricultural commodity trade. Because of special characteristics of its products such as perishability, seasonality, and bulkiness, it has been said that agriculture is uniquely dependent on a dependable and flexible transportation system (15). Factor proportions probably do dominate the determinants giving rise to relative costs and price differences of such commodities as processed fruits and vegetables, dehydrated potatoes, coffee, tea, sugar, and cotton. With respect to these kinds of goods, the degree of specialization would still be modestly affected by transport costs. However, in the instance of perishable commodities requiring refrigeration and rapid transit times, transportation costs are frequently the dominant element in final delivered overseas sales prices. In one instance, the case of Washington State apple exports to Stockholm, Sweden, the value of the apples at the packing house was found to be about seven cents per pound and an additional nine cents per pound was required to cover handling and shipping costs to the overseas markets (1).

The enigma of international trade economists' tendency to downplay transportation considerations is further underscored by the fact that interregional trade and regional development theories have accorded much more importance to transportation considerations, even when the spatial obstacle is of a lesser degree of absolute importance there than for international trade. In contrast to the practice of classical trade theory which almost ignores entirely the transport cost in traversing space, these branches of economics accord major attention to transportation oriented location of industry (for example, see 9, ch. 5; and 3). Presumably the explanation lies in the fact that interregional trade within political boundaries is not complicated by trade restrictions and currency differences as is the case with international trade, and consequently transportation considerations are more clearly recognizable.

Furthermore, historical perspective presents a curious dichotomy when the relegation of transportation considerations by the classical trade theorists, in the nineteenth century, is contrasted against transportation developments during that era. The growth of world trade in the nineteenth century was an involved process, but one of the major causes of that expansion was a revolution in transport connected with the development of railroads and steam ocean transport. New territories including the formerly underdeveloped regions of the United States, Canada, Argentina, and Australia were opened up to become exporting areas of agricultural and other products with the development of railroad transportation. At the same time, development of steam ocean transport made possible an increased level of trade between countries separated by considerable water distances.

## TRANSPORTATION AND SPATIAL EQUILIBRIUM MODELS

Neoclassical and so-called modern trade theories have all suffered from the same lack of applicability or usefulness in empirically analyzing factors underlying trade patterns in international commerce as did the classical theory. The single point in space treatment of trade between countries led one student of international trade theory to comment: "So radical an idealization is this that it is any wonder that the theory has any bearing on reality at all" (4, p. 477). While largely unnoticed by international trade economists, some fairly recent attempts have been made to introduce transport considerations into international trade models by incorporating transportation costs either directly, or indirectly, through inclusion of distance or spatial aspects of trade between entities. Isard and Peck (1954) attempted to fuse the opportunity cost doctrine of trade theory with location theory in a model and demonstrate how variation of the distance factor shapes geographical specialization and composition of trade (10). Samuelson presented the trade problem within a spatial equilibrium framework that simultaneously considered supply, demand, and transport cost interrelations between different countries (17). It has been within this latter framework that applied economists, and particularly agricultural economists, have made some of the most significant strides in modeling international trade flows and patterns (for example, see 2, 11, 13, 18 and 20). It could also be argued that it is in this framework that transportation specialists have much to offer. Spatial equilibrium models and their precursors, transportation linear programming models, to date suffer from a simplistic presentation of transportation considerations almost exclusively in the form of freight and handling charges based upon geographical distances between ports. Back hauls, frequency of service, transit time, quality of service, suitability of support facilities, inland-overseas linkages and numerous institutional con-

straints are treated only in a token fashion if at all. Transportation specialists are at an advantage comparatively speaking in sensing the role of these factors and thus stand to offer a great deal in the further refinement of this potentially useful category of empirical techniques.

## TRANSPORTATION COSTS AND INTERNATIONAL TRADE

Three types of effects can be traced from the influence of transport costs on prices and trade in the world economy. Transportation costs prevent the complete equalization of prices of traded goods that would otherwise occur under the assumed conditions of free trade in pure international trade theory. Secondly, they influence the volume of world trade. Thirdly, transportation costs affect the patterns of goods flowing in the world market channels.

The first point is primarily of academic interest. Transport costs are reflected in differential prices in international trade; prices in the importing country tend to be higher than in the exporting country by the amount of these costs.[6] Stated somewhat differently, transportation costs create a spread between prices paid by importers and received by exporters. However, it is important to the extent that when the incidence of these costs fall upon the exporter he receives a lower price. Meanwhile, the portion borne by importers represents a higher price.

With regard to the second point, the existence of transport costs create a "natural tariff" that curtails the volume of trade. Since only those goods that can bear the transport costs (and still remain cheaper than the same domestically produced goods in the importing country) will be traded between countries, international specialization will be substantially less. Stated somewhat differently, the removal of transportation barriers has the same impact as the removal of governmentally imposed trade barriers; permission of greater international specialization and therefore a higher potential standard of living. Haberler among others has recognized this, "The necessity of paying transport charges makes the world poorer" (5), but he and others have been hesitant to include policies or decisions that lower transport costs as instrumental variables in their models. Indeed a significant portion of this so-called natural barrier is in fact imposed by government policies. Cargo preferences, steamship rate setting conferences, and other legislatively or administratively imposed practices that obstruct cargo moving by modes selected upon a competitive commercial basis are cases in point.

Finally, the third point is that transportation considerations can be an active determinant of the composition and pattern of trade. If trade between countries is viewed in a multinational setting, then spatial arrangement (and thus transportation costs) obviously becomes a potentially significant consideration in whether the United States Pacific Northwest or the Netherlands will export potatoes to the Federal Republic of Germany. Moreover, the efficiency of the internal transportation system in a country could help explain its competitive position vis-a-vis other exporters. Undoubtedly, Brazil's inferior interior transportation system relative to that in the United States is an element in the relative competitive status of soybean exports from the two countries. Furthermore, technological developments in international transportation systems are not neutrally and evenly dispersed among different countries or regions or commodities. Subsequently the evolution of LASH and SEABEE ships may alter the composition and pattern of trade for certain regions uniquely able to exploit the advantages of this integrated inland-ocean mode of water transportation.

Transportation may be viewed as a cost, and therefore, as a barrier restricting the realization of potential gains from specialization. Alternatively transportation may be viewed in the Isard tradition as simply another input whose services are "needed to move raw materials, equipment, labor, and finished products to appropriate places" (9, p. 90). Whichever view is taken, it is obvious that transportation plays an important role in international trade. Analysis of this role has been shied away from by international trade economists. This is perhaps suggestive that transportation economists might have something to offer by looking at transportation matters in the context of their role in international trade. While the impact of trade on transportation is a logical consideration it is equally logical to recognize the mutually interdependent nature of the two and consider the impact of transportation considerations on international trade. After all, the function served by transportation of goods is to facilitate the realization of welfare gains derived from specialization and division of labor between individuals, regions, and nations.

## INTERNATIONAL TRANSPORTATION DEVELOPMENTS

We have considered international trade in the context of its theoretical relationship to transportation. In this section a series of relevant technological developments in international transportation will be discussed. For many, this would immediately bring to mind the large scale ocean movement of bulk grain in huge bulk carriers and super tankers. However, a series of developments affecting other categories of agricultural products will be primarily emphasized. These are products that historically would be included under the category of general cargo, break bulk, or mini-bulk cargoes because either the nature

of the commodity, or small individual shipment volume, precludes the bulk techniques associated with grains, soybeans, etc. Agricultural commodities included in this list include fresh, frozen, and processed fruits and vegetables, hides, hay cubes, dry pulses, and chilled, frozen, or processed meat products.

If one looks at recent trends in international transportation of the commodities noted above, the most notable consideration is a technological revolution in general cargo movement that has transpired since the late sixties. Introduction of standardized modular containers has effected substantial economies, both in transportation systems and cargo handling systems. The container revolution has advanced the intermodal concept to the point where door to door delivery of goods is practical on transoceanic voyages, as well as inland voyages, under one bill of lading. Variations of this series of integrated intermodal innovations are numerous. Among the more prominent developments are container carrying ocean freighters, roll-on roll-off ships that carry truck-trailer rigs to overseas destinations, refrigerated ("reefer") and atmospherically controlled containers designed for intermodal shipment, lighter-aboard-ship (LASH) and SEABEE vessels that carry barges thereby integrating inland and ocean water transits, as well as land and mini-bridge systems of unitized rail transport across continents that short cut interoceanic canal and cape water routes. These technological developments are only one dimension, albeit an important one, of a movement away from general cargo freighters towards specialized shipping. The container revolution shares the trend toward specialized shipping with bulk liquid and dry cargo tankers and carriers that have had such enormous impact on oceanic transportation in recent years. Another facet of the revolution evolves from containerized intermodal transportation combined with wide hull jumbo aircraft, a development that promises to usher in an era of intense competition between ocean and air-surface modes of transporting certain high value or perishable commodities that necessitate assigning high priority to rapid delivery.

Speaking now of the impact of these developments on inland transportation patterns and systems, the many changes in international transportation systems in the past decade have rendered many ports obsolete in location and design, thus creating demands for new facilities and locations. In addition, the intermodal container revolution has had enormous impact on the patterns of internal flow of commodity traffic as it moves to the interface port segment of overseas transit. Two offshoots of containerized ocean shipping exemplify the consequences of this international transportation development on ports and inland systems character and development particularly well; the load center concept and mini-bridge.

Containerships, because of the large investments in the vessels, cannot afford to call on ports unless they offer substantial volumes of cargo and can provide for rapid turn around. This has given rise to the so-called "load center" concept where only a few major ports are called upon. As a result it is reported in a recent study that Portland on the West Coast, and Philadelphia on the East Coast, have suffered from diversion of substantial portions of cargo to Seattle and New York respectively (14). However, in the total framework of transportation considerations this need to eliminate some port calls has run head on into the trade-off need to emphasize many ports of call to accommodate the emerging concepts of through transportation and total distribution (8).

Of the various developments that have resulted from containerization, the so-called "mini-bridge" concept has perhaps been the most controversial. Mini-bridge involves the joint rail-ocean movement of cargo from East Coast points to Asian ports, and West Coast origins to Europe, as opposed to the cargo moving by ocean-vessel around through the Panama Canal. The rapid transit of containers on unit trains, coupled with shortened distances when cargo is routed across the continent as opposed to the Panama Canal, explains the major economy to be derived from this system. For example, approximately 2,000 miles and possibly four days are saved by routing cargo from the East Coast to Japan via railroad as opposed to the interoceanic Panama Canal route. Similar distance and time economies are available to shippers near the West Coast if their cargo is going to Western Europe.

This system suggests obvious advantages to areas shipping substantial quantities of perishable and containerizable products to overseas markets, particularly if previously they have had to rely on routing their cargo around the Panama Canal. The main impact on the domestic transportation system is that mini-bridge, of course, routes a relatively higher percentage of freight by rail, plus it obviously affects the port to be involved in the transshipment of the cargo to an ocean vessel for the waterborne leg of the journey.

The above mentioned developments only scratch the surface of technological developments that are unfolding in the international trade scene. They were mentioned to dramatize the dynamic nature of developments in the logistics of moving goods internationally and further point up that transportation costs and considerations perhaps deserve greater attention than historically accorded by international trade economists.

## INTEGRATING INTERNATIONAL TRADE AND TRANSPORTATION RESEARCH

International trade models are apt to be bereft of much empirical application and meaningful interpre-

tation if they assume a single-point-in-space world. The spatial equilibrium framework suggested by Samuelson and fashioned by Takayama, Judge, and others into an empirical framework has the merit of incorporating factor endowment, demand, and transportation considerations into an interdependent framework. Moreover this framework is extremely versatile in that it allows a number of considerations, transportation and otherwise, to be treated as instrumental variables and simulated so as to estimate their impact on trade. Bawden demonstrated the approach to be amenable to incorporation of ad valorem duties, variable import levies, export subsidies, import quotas, and domestic policies that affect trade movements.

The impact of international transportation developments upon trade flows, and supporting distribution facilities, can be estimated by specifying various alternative transportation cost data sets and pursuing their effect through these models. Sharp and McDonald, for example, used the transportation model to analyze the impact of vessel size on an optimal system of U.S. grain export support facilities (19). A project was recently initiated at the University of Idaho to estimate least cost modal combinations and routings with particular emphasis on the impact of LASH and container carrying barges on the Pacific Northwest export distribution system.[7]

While spatial equilibrium and transportation models offer a potentially useful framework to incorporate transportation considerations into international trade models, there is a great deal of work to be done to improve their productivity. As suggested earlier it is commonly recognized that the diversity of influences involved in transportation considerations tends to be glossed over. Transportation costs are too narrowly defined when specified as a simple function of freight rates and distances.

Finally, as any researcher would naturally suspect, a most critical aspect of employing these models fruitfully hinges upon acquiring adequate data. A particular problem exists with regard to specific inland origin of U.S. exports to overseas destinations. Information indicating the origin of exports by states or regions is not reported on export declarations used by the Census Bureau to compile U.S. export statistics. Consequently, primary data must be collected in most instances to furnish the inputs for these models and this is an ambitious undertaking in its own right. However, it is necessary, particularly for studies concerned with efficient transportation and accompanying support facilities, to have this data. The Bureau of the Census in the Department of Commerce, in conjunction with the Department of Transportation and other agencies, has announced they are beginning a survey to obtain data on the movement of exported commodities within the U.S. A similar survey was conducted in 1970, but unfortunately it was too aggregative in scope for many purposes (21). A recent study by Hill and Brooks provides another example where a survey technique was utilized to gather primary data regarding in that case, grain movements by specific mode to export points from Illinois (7).

In conclusion, I hope I have underscored the theme that transportation considerations are vital but sadly neglected in international trade research. Furthermore, I have attempted to suggest some of the dimensions of this problem that might be tackled by transportation specialists.

## FOOTNOTES

[1]AE Research Series 205.

[2]For a discussion about the debate among historians of economic doctrine as to which of these two economists in the classical school deserve credit for initiating the principle, see (4, pp. 479–482).

[3]The results of a study by Leontief contradicted the prediction of the factors proportions theory and set off a series of empirical and theoretical investigations that have thus far been inconclusive except to demonstrate that the theory in its simplest version is inadequate. For a review of this debate see (6).

[4]It should be noted that Ohlin himself placed considerable emphasis on transportation considerations, though that part of his work went relatively unnoticed by later trade economists, see (16).

[5]Transport costs are implicitly recognized in the classical proposition that international trade differs from interregional trade in that factors are immobile between states, but as Chipman noted the inference is that they are infinite in this instance and zero otherwise, with nothing in between (4, p. 511).

[6]For a general equilibrium and partial equilibrium demonstration of these effects, see (12).

[7]"LASH and Other Intermodal Services in the Pacific Northwest Export Distribution System." The project was funded by CSRS for the period July 1, 1976, to June 30, 1981. A related project considering the impact of these developments upon the Columbia-Snake navigation system, particularly with regard to the implications for modifications in shore support facilities, is envisioned to be initiated, pending formal approval by the Sea Grant Office of the U.S. Department of Commerce.

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# The Unit Train's Role in Furthering International Trade*

M. H. Swanson
Vice President for Transportation
Agri-Products Group, Cook Industries, Inc.

To start out with, let me tell you a little about Cook Industries. Cook Industries is a diversified company with major interests in the principal areas of agribusiness, building products and services. Founded in 1919 as a cotton merchandising company, Cook established its Grain Division in 1961. In 1969, Cook merged with E. L. Bruce Company, a major manufacturer of hardwood products and related goods. Riverside Industries, a complex of agribusiness related companies engaged in the manufacture and sale of agricultural fertilizers, chemicals and mixed feeds, and the processing and refining of cottonseed, soybeans, and derived oil products was acquired in 1969. In addition, the company has interests in pest control services and insurance. Most recently, we started a department for the merchandising and exportation of rice.

Cook Industries is not a newcomer to international trade. Our first trade was an export sale of cotton to Holland in 1921, more than half a century ago. Our first export shipment of grain was made in 1961. The company now ranks among the major U.S. exporters of grain, grain products, and soybeans. We have our own merchandising offices in 12 foreign locations and work through agencies in many other countries.

As an adjunct to these interests in the marketplace, the company has become involved in the rail, barge and ocean transportation sectors of both U.S. and world markets. Cook Industries operated around 1700 rail cars, 200 barges, and 15 ships. Our total direct transportation charges exceeded 125 million dollars last year. This is but a part of the total transportation cost of the products Cook handles. There is a large amount either bought on a delivered basis or sold f.o.b. our export elevators on which the other party pays the carrier.

*Editor's note: Topic suggested by Planning Committee was "The Domestic Transportation System's Role in Furthering International Agricultural Trade."

## INTRODUCTION

This symposium is designed to present findings of research and to stimulate new research on transportation problems facing agriculture, forestry, and rural areas. In discussing "the role of inland transportation systems in expanding international trade," most of my time will be spent on the new round of larger unit train rates which the major corn and soybean originating rail carriers are presently initiating.

The role of any inland transportation system in expanding international trade can be reduced to two words, "cost savings."

Through efficiencies in the system, any cost savings that can be realized put our producer and the world consumer closer together and serves to keep the U.S. more competitive in the marketplace.

If you have not already, you might be interested in reading the November 8, 1976 issue of Business Week which carries an article about the new round of unit train rates entitled, "The Rails Unlock Iowa Corn."

## INLAND TRANSPORTATION SYSTEMS

The agricultural marketing system is a complex of many activities and transportation is an essential part of that system. Almost none of the problems experienced in grain transportation during recent years are new. Rail car shortages, for example, have occurred more or less annually in varying degrees throughout the modern history of the industry. There is value in briefly reviewing some aspects of the past because we are talking about problems which are old and chronic.

Following the inauguration of the agricultural adjustment programs in the early 1930's, the marketing and transportation systems for U.S. agriculture developed largely as an adjunct to agricultural production. This was inevitable since the price supports available to producers were contingent on "storage in the area of production." Consequently, the warehousing and storage systems that developed for all commodities affected by the programs were heavily concentrated in the more remote and least accessible areas of production. This trend was intensified in the 1950's when producers were strongly encouraged to provide "on-farm storage" for surplus grain stocks.

The basic fact is that our grain storage and transportation facilities were not conceived and are not designed to accomodate the new role which has been thrust upon the system. That role is, of course, from a residual supplier of grains and products just 5 years ago, the United States has emerged as the dominant producer/supplier of food and feed grains for the world. U.S. agricultural exports have increased from 6.6 billion dollars in 1966 to 22 billion dollars presently. Agricultural exports are now the single most important factor in our balance of trade. In grain and soybeans alone, the U.S. provides more than 50% moving in international trade. We now export 60 percent of our wheat, 50 percent of our soybeans and 25 percent of our corn. In an atmosphere like this, the consummation of a purchase or sales agreement can depend on, not dollars, but cents per ton. The scale, as well as the suddenness of this new role, has highlighted the shortcomings of the old system and forced some of the changes we are now seeing happen.

Before I get into what is now in the process of taking place in unit train rates, let me give you a brief history of their evolution.

## HISTORY OF UNIT TRAIN RATES

Grain rates until 1968 were relatively stable. By stable, I do not mean that the rate levels were not increased; I mean that the railroads were not very innovative in approach. Single, or at best, small multiple car shipments published with no transit to apply were the order of the day. Then all of a sudden, a new concept was introduced by the Illinois-Central Gulf Railroad. The concept had originated in November 1967, but was suspended by an Interstate Commerce Commission Hearing Examiner (see ICC Docket 34905, Grain by Rent-A-Train). That suspension subsequently was upheld by both Division 2 and the full Interstate Commerce Commission. The two objectionable features were then eliminated, those being, (1) the dedication of carrier equipment to a single shipper to be unjustly discriminatory and unduly preferential and prejudiced, and (2) the 25 miles per hour "guaranteed minimum speed" and the provision for liquidated damages for failure to meet that schedule on any trip to be not just and reasonable. The re-issue of IC 19597 series, Rent-A-Train Tariff, ushered in a new era in grain rate making.

In April 1969, the Norfolk and Western Railroad published the first train rates from Illinois to the east coast. This rate was based on 5 consecutive movements of 100 cars with a minimum of 10 trips per year.

In 1970, the Chicago, Rock Island and Pacific Railroad published its 54 car export unit train rates to Gulf ports for export. This was Iowa's first chance to really compete against Illinios, as a major export grain origination state. Then in July, 1972, the Chicago and Northwestern Railroad published its 25/50 car export rates with the Milwaukee Railroad following suit and publishing in late August 1972. Since 1972, in the midwest to gulf coast, there have been small refinements in the rates along with a dizzying escalation in level and even a few additional

carriers joining in with a "me too" but, no real breakthroughs until this year.

There also were some unit train rates published on corn and soybeans from the midwest to the west coast. These rates published by the Burlington Northern, Union Pacific, and Milwaukee Railroads have not moved very much, if any, grain and there have been rumors of cancellation. The fact is that the ocean freight rate spreads between Gulf and Pacific ports are just not sufficient at the time to move the grain via the west coast even if the rail rates were substantially lower.

1976 is bringing a new generation of unit train rates. These new rates are approaching the levels that Dr. Phillip Baumel of Iowa State described as optimum to move grain from Iowa into export channels with the greatest efficiency for railroads and maximum financial return to the Iowa agricommunity.

## TODAY'S UNIT TRAINS

When I talk about unit trains, I mean enough cars that they may be operated as a full train without adding extra cars.

The Rock Island Railroad's 54-car rates did not qualify because they allowed multiple origins. Also, those rates along with the Chicago-Northwestern and Milwaukee Roads 25- and 50-car rates were not always applied on units operated as a train, but in many cases were applied for those units that then were tacked onto other units or trains to make full complements of cars for movement to the gulf.

There is no magic number of cars needed to qualify as a unit train. It is an individual exercise for each railroad to calculate what is optimum for their power, condition of their roadbed, and prevailing grades. In the case of the Chicago and Northwestern and Milwaukee, it appears to be 75 cars to the gulf. The Chicago, Rock Island, and Pacific originally was thinking something closer to 80 cars, but backed off to 75 to remain consistent with the CNW and MILW. The Illinois Central-Gulf Railroad has always used larger trains and prefers to handle 115 cars in a unit.

Secondly, the train must handle some specified number of consecutive trips. From the standpoint of the railroads, I am sure they would prefer year around movement, if possible, because if for no other reason, it gives more trips over which to spread the cost of accumulating the cars and a better chance to program labor and locomotive needs.

It is extremely difficult for many firms in the grain industry to keep a unit train in consecutive operations for a 12-month period. The best testimony to that fact has to be the Illinois Central-Gulf Railroad's original rent-a-train which was set up to move consecutively for 12 months to gain the best rate. Because of lack of interest in this proposal, the so-called "Colt 45" was formulated which calls for 45 trips of 11,500 tons each. This has generated much business and for the State of Illinois, at least, seems to be a very workable situation. Being very practical, the minimum should be at least five trips to justify its being called a unit train. I believe that the Norfolk and Western and ConRail have the best approach in their sliding scale. The rate decreases as the number of consecutive trips per year increases. This gives the shippers an incentive to keep the train operating as long as possible, but also gives them the opportunity to weigh potential grain price premiums against freight rate considerations.

Since we have not seen the tariff supplements that will apply for Iowa to Gulf movements, I cannot give you all the new rates which will apply, but can illustrate how they will apply at our two new Iowa elevators for export movements to various Gulf ports:

| *Railroad and Origin Points* | *Number of cars per shipment* | | | |
|---|---|---|---|---|
| *ICG* | *Single* | *3-Car* | *59-Car* | *115-Car* |
| Denison, IA | 77½ | 71½ | 64½ | [1]55 |
| | *Single* | *25-Car* | *50-Car* | *75-Car* |
| *MILW* | | | | |
| Hartley, IA | 84 | 74 | 67½ | [2]63½ |
| *CNW* | | | | |
| Denison, IA | 77½ | 70½ | 64½ | [3]58 |
| *Rock Island* | | | | |
| Hartley, IA | 84 | 74 | 67½ | [4]63 |

[1]Effective 8-27-76
[2]Estimated effective date 1-1-77
[3]Estimated effective date 12-18-76
[4]Effective 12-18-76

Let me now briefly explain some of the freight savings factors of a unit train.

## FREIGHT SAVINGS FACTORS OF A UNIT TRAIN

I have not included a lot of in-depth research data on the justification for the reduced rates for two prime reasons:

1. Excellent studies of railroad costs have already been prepared by several people. One, in particular developed by C. Phillip Baumel and W. H. Thompson of Iowa State University, is "An Economic Analysis of Alternative Grain Transportation Systems" published in October 1973. Dr. Baumel in conjunction with John J. Miller and Thomas Drinka in March of this

year, published their "Economic Analysis of Upgrading Branch Rail Lines in Iowa." There are other sources available for this type of data, but none of which I am aware is so comprehensive. At any rate, much of the data needed is already available somewhere, and for a relatively new company in the grain business like Cook, a staff of sufficient size and expertise has not yet been developed. To be entirely realistic about the whole transportation research field, I am not sure but what the academic world is better prepared to begin with. I know that both transportation suppliers and consumers will furnish information to outside independent study groups like universities, when they will not share the same information with each other.

2. Regardless of the hard cost numbers, negotiating freight rates with rail carriers still comes down to the old adage of "what the traffic will bear." In my experience, railroads do not publish freight rates on the basis of cost plus profit. The emphasis is on what is the lowest existing competitive rate and how much has to be trimmed off of that to offer enough incentive to move new traffic at the new levels. If there are not railroad cost-saving elements such as annual volume guarantees, reduced free time before demurrage begins, increased demurrage charges, unabsorbed switching, shippers' equipment provisions, or other items, maybe reducing the rate to the level of competition will move traffic. But, if some of these items enter the new proposals, there must be a cost tradeoff for the shippers of a commensurate decrease in the rate level itself for the rate to move new traffic.

Equipment utilization is a prime factor in railroads' ability to price unit trains more competitively. There are several studies prepared by various groups which compare the average turnaround time of unit trains with that of single car shipments. Cook's experience is that single-car shipments from Iowa to the Gulf exceed 30 days average turn while unit trains to the same ports will average close to 15 days. New covered hopper cars today are leasing for around $325.00 per month, or $10.50 per day, and with a maximum load of 200,000 pounds of grain, improved turnaround amounts to about 8 cents per hundredweight savings in increased equipment utilization alone. The savings are just as real regardless of whether the shipper or the carrier furnishes the equipment.

This figure can vary greatly between individual carriers. For example, some carriers average around 10 day turns on the equipment. Using the same values, this amounts to over 10 cents per hundredweight. It would appear that equipment utilization is going to continue being a major potential source of saving when you consider, according to Robert H. Leilich in "Economics of Short Trains," that "The annual cost of providing freight train equipment has increased at twice the rate of freight train labor expenses, as measured in terms of revenue per ton mile."

Switching cost is another area where considerable savings can be gained. A single car shipment via a joint carrier route would normally be handled a minimum of 8 times. That would be—(1) out of the loading facility, (2) classification and making-up of origin carrier's train, (3) breaking up of origin carrier's train, (4) to interchange by origin carrier, (5) from interchange by destination carrier, (6) classification and making-up destination carrier's train, (7) breaking up destination carrier's train, and (8) switching into unloading facility. If the train was not made up in a solid block at origin destined to the interchange point or in a solid block from interchange point to destination, there could quite possibly be additional breaking, classifying, and making-up of trains at intermediate terminals on either the origin or destination carrier. Unit trains can be blocked at the loading facility and moved straight through to destination without even changing the power units.

There are so many variables that it is extremely difficult to pin down the exact savings in switching costs. Each railroad has its own figures for the yards in which the cars are handled. This depends greatly on whether the yard is over- or under-utilized, the physical layout, and how expenses are allocated. I discussed this subject with several carriers and only one felt justified in sharing its costs with me. It indicated that around a 50% reduction in switching could accrue with unit trains which would equate to about 2½ to 3 cents per hundredweight.

Labor savings also contribute to the railroads' ability to reduce rates in unit trains. Let me treat this subject with a generalization that makes me believe that labor savings are not as significant as equipment or switching. According to Robert H. Leilich in "Economics of Short Trains," approximately 15 to 20% of total railroad costs are attributable to direct variable, above the rail operating expenses for moving trains between yards and terminals.

Elimination of transit privileges and of stopping cars for inspection while in transit are two more items that have contributed to the reductions in unit train rates on the carriers' side of the fence.

There are additional savings that can accrue to the shippers and receivers of unit trains. They all are directly derived from the improved logistics and transit time that unit trains provide.

1. Avoidance of demurrage on both the rail cars and the vessel because of more dependable arrival of the product.
2. Avoidance of building excessive storage capacity.
3. Interest savings on the money for the shortened time span between paying for grain and being able to load it on a vessel.

## RECOMMENDATIONS TO FURTHER STRENGTHEN THE INLAND TRANSPORTATION SYSTEMS

1. Dr. Baumel will speak more directly to this subject. However, all the shipping public, if they want a strong, privately held rail transportation system, should support established authority for the ICC to provide for orderly and expeditious suspension of service and/or outright abandonment of trackage that is truly a profit drain on the railroads. Along these same lines, we should not fight the railroads or other forms of transportation in their quest to be adequately compensated for the transportation services they perform. That is not to say we must support every individual or Ex Parte increase that comes along. By the same token, when rate increases are pending to bring rates above out-of-pocket cost levels, we should not oppose them. When we do that for the sheer sake of holding down rates, we may very well be hurting ourselves the most in the long run.
2. We should support the continuation of investment tax credits which offer incentives to both transportation companies and the private shipping public to acquire equipment. In that same area, railroads should be able to see the wisdom of providing private owners of equipment some combination of mileage and/or per diem commensurate with the cost of owning and operating that equipment. This would allow the railroads to concentrate more capital on power and trackage which in turn helps improve equipment utilization.
3. Lines of communication must be kept wide open between federal regulatory agencies and transportation users. Federal regulatory agencies should gather pertinent facts before acting on critical transportation matters. The general public often armed with few facts, brings pressure to bear and sometimes, causes regulatory agencies to overreact in emotion rather than good sense. I do not want to appear critical of our federal regulatory or administrative agencies because those lines are more open now than ever before and the signs are of an ever increasing rapport.

   A classic example of reacting in emotion because of public pressure is the recommendation of the Bureau of Enforcement of the Interstate Commerce Commission in Ex Parte 307. They have promulgated rules which would allegedly make for a more equitable distribution of rail equipment. Among the recommendations is the abolition of the consecutive movement provisions of unit train rates. Whether the effect would be a more equitable distribution of equipment remains to be seen. It is highly probable however that it will eliminate unit train rates in railroad equipment. If we lose the rates, we will be stepping backwards almost 10 years in terms of efficient low cost grain transportation. Loss of the progress of that 10 years is something that Americans, from the farmer to the consumer, cannot afford.

   The Interstate Commerce Commission's Bureau of Enforcement has had ample opportunities to eliminate unit trains, but instead, choose—through Service Orders—only to limit the percent of covered hoppers dedicated to them. In fact, on occasion, I have heard representatives of the Bureau openly admit to the economies and efficiencies of unit trains.
4. All the public must let their wishes be known to their legislators so that more problems like the Lock & Dam 26 issue do not come to pass. In case some of you are not fully aware of what happened, when the Senate Public Works bill, which included Lock and Dam #26, was being passed out of committee to the floor, a users charge, for the inland waterway system was tacked on to the bill. I don't believe that anybody within the shipping public wants to see one form of transportation favored or disadvantaged over the others through taxation or subsidies. And although very convincing arguments could be brought forth, both pro and con, on users charges, nothing should be done until the item is fully investigated. This users fee, or charge was not fully explored in committee and could certainly have detrimental effects on the viability of the inland waterway system. At any rate, when the Public Works Bill came before the full Senate, it looked as though Section V, or the users charge, might be deleted, and under threat of filibuster, Lock & Dam #26 was also deleted. If more people would have indicated to their legislators the importance of Lock & Dam #26, this should never have happened.

## CONCLUSION

Agricultural movements are more than just contributors to the overhead of transportation companies. Today, these movements are for the account of many major contributors, from the standpoint of both volume and profit. Traffic will swing back and forth between carriers on an intermodal as well as intramodal basis. The unit train is an excellent example of both cases, where some rail carriers took business away from both water and other rail carriers. For the carriers to effect the reductions of rates there had to be corresponding increase in efficiencies. These efficiency gains help the transportation companies and consumers alike and are

something none of us can afford to lose. To gain even better utility of equipment and to keep U.S. agricultural products competitive in the world marketplace, the expanded use of unit trains, as a transportation system for agricultural products, and other innovative ideas by all carriers, should be encouraged and applauded, not stifled by rules and regulations that would maintain the status quo.

# Coordinating Movements of Cooperative Export Grain

Stanley K. Thurston and Robert J. Byrne
Senior Agricultural Economists, Grain and Transportation, respectively
Farmer Cooperative Service, U.S. Department of Agriculture

"Coordinating movements" means that some central force or organization seeks to use a significant but limited amount of power to legally arrange and influence the movement of grain. "Cooperative export grain" is originated by farmers through their cooperatives and shipped all the way to a U.S. port elevator or foreign port. And, most surely the farmer and his cooperative want it to be an efficient effective movement. Cooperatives seek to give their farmer members a greater return than they would get without the co-op effort. In becoming more efficient in the coordination of grain movements, the co-op can increase returns to grain producers.

In many instances people and organizations have much more potential power than they ever develop and bring to bear on a given situation. Regional grain cooperatives, individually and collectively, have considerable undeveloped power to become more efficient and effective in moving grain to export points.

We think you can more easily understand the position, objectives, and problems of co-ops in grain export movements if we give you a brief profile of grain co-ops, their export movements, and their particular problems in coordination. Following that, we'll discuss what cooperatives have done to improve coordination and what they can do in the future.

## PROFILE OF GRAIN COOPERATIVES

### Number of Cooperative Elevators

Grain cooperatives generally fall into two categories: local and regional. Local cooperatives have country elevators that receive grain directly from farmers. Regional cooperatives generally purchase or handle grain from local line or affiliated elevators within a relatively large land area ranging from several counties to several states. According to a recent Farmer Cooperative Service (FCS) survey, it was found that 2,288 local cooperative associations that were members of one or more of 14 regional grain cooperatives had a total of 4,167 country elevators (2). In addition, regional grain cooperatives had 357 country line elevators. We roughly estimate that cooperatives have 40 percent of the country elevator capacity and handle 40 percent of farm sales at the country elevator level.

The 14 regional and 4 interregional cooperatives had 83 terminals or subterminals. Of this total, 9 were port elevators and 74 were inland elevators. Among the inland elevators, 21 were river elevators that ship grain by barge to port elevators and other domestic points.

### Location and Capacity of Elevators

The inland cooperative elevators are concentrated generally in proportion to the density of off-farm grain sales. The river elevators are located principally on the Mississippi, Columbia, Illinois, Snake and Missouri rivers. The headquarters of the 18 largest regionals are concentrated in the midwest and Great Plains areas (Figure 1).

The storage capacity of regional cooperatives at subterminal and terminal locations totaled 400 million bushels. Of this total, 291 million bushels were at inland locations, 50 million at navigable rivers, and 59 million at port locations.

### Cooperative Port Elevators

In 1974, nine cooperative port elevators were among the 67 port elevators in the entire United

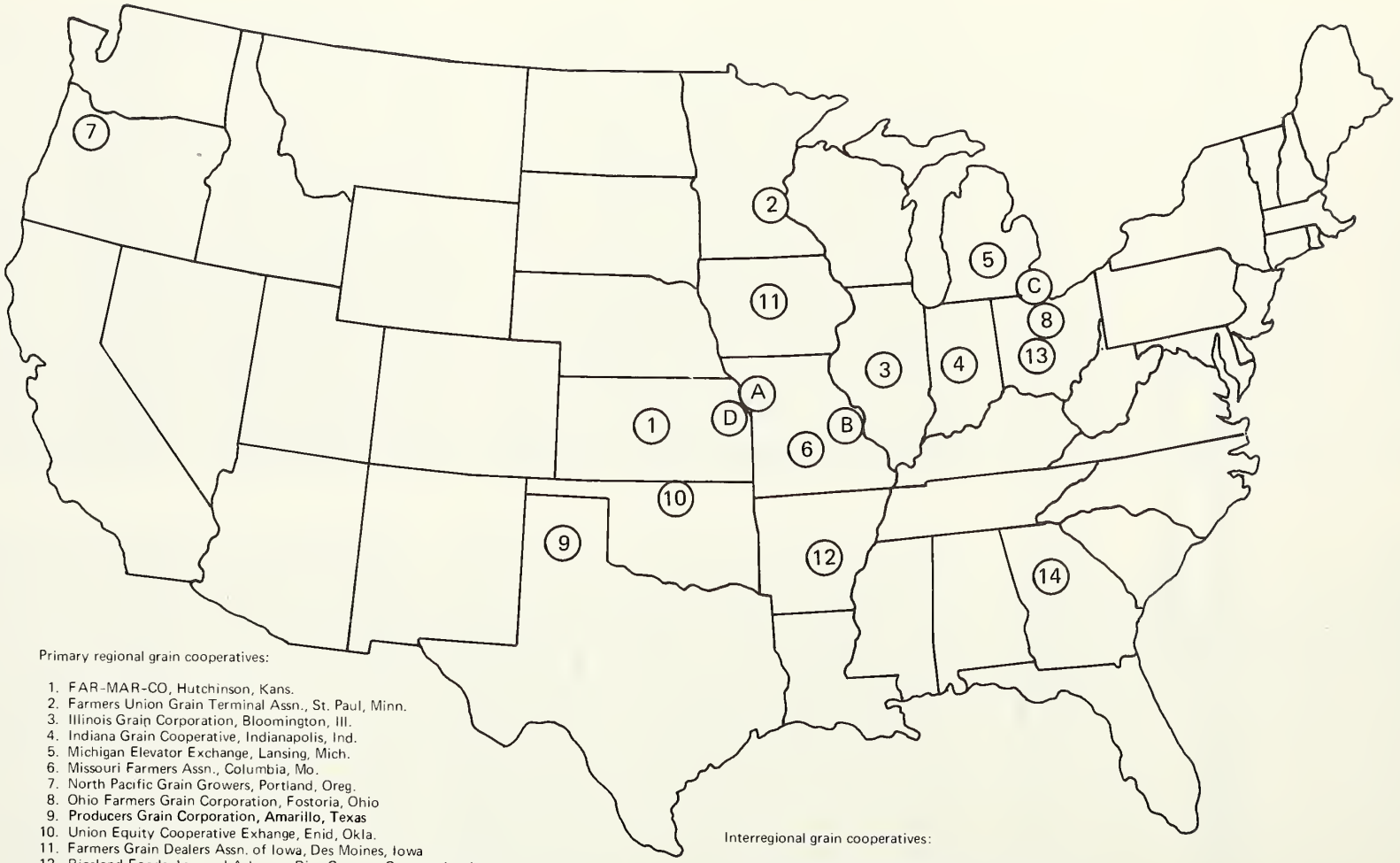
Primary regional grain cooperatives:
1. FAR-MAR-CO, Hutchinson, Kans.
2. Farmers Union Grain Terminal Assn., St. Paul, Minn.
3. Illinois Grain Corporation, Bloomington, Ill.
4. Indiana Grain Cooperative, Indianapolis, Ind.
5. Michigan Elevator Exchange, Lansing, Mich.
6. Missouri Farmers Assn., Columbia, Mo.
7. North Pacific Grain Growers, Portland, Oreg.
8. Ohio Farmers Grain Corporation, Fostoria, Ohio
9. Producers Grain Corporation, Amarillo, Texas
10. Union Equity Cooperative Exhange, Enid, Okla.
11. Farmers Grain Dealers Assn. of Iowa, Des Moines, Iowa
12. Riceland Foods, Inc. and Arkansas Rice Growers Cooperative Assn., Stuttgart, Ark.
13. Landmark, Inc., Columbus, Ohio
14. Gold Kist Inc., Atlanta, Ga.
Interregional grain cooperatives:
A. Kansas City Terminal Elevator Co., Kansas City, Mo.
B. St. Louis Grain Corporation, St. Louis, Mo.
C. Mid-States Terminals, Toledo, Ohio
D. Farmers Export Co., Overland Park, Kans.

**Figure 1. Location of headquarters of regional grain cooperatives, 1975**

States. These nine cooperative elevators were operated by eight different regional cooperatives.

*Location and capacity*.—Four cooperative port elevators were situated on the Great Lakes, one on the Atlantic coast, three on the Gulf coast, and one on the Pacific coast. Specific locations were Superior, Chicago, Saginaw, Toledo, Baltimore, Ama (La.), Houston, Corpus Christi, and Kalama (Wash.) (Figure 2).

Port elevators are fairly well distributed among all coasts including the Great Lakes, however, most of them serve only one regional. The exceptions are Farmers Export Co. at Ama, La., and Mid-States Terminals at Toledo, that serve their several member regionals.

*Comparison of cooperative and total U.S. port capacity*.—The total port capacity of the nine cooperative port elevators totaled 59 million bushels, or 17 percent of the U.S. total port elevator capacity. Cooperative port capacity as a percent of total U.S. port capacity was 23 percent for the Great Lakes, 9 percent for the Atlantic coast, 16 percent for the Gulf coast, and 8 percent for the Pacific coast (Figure 3).

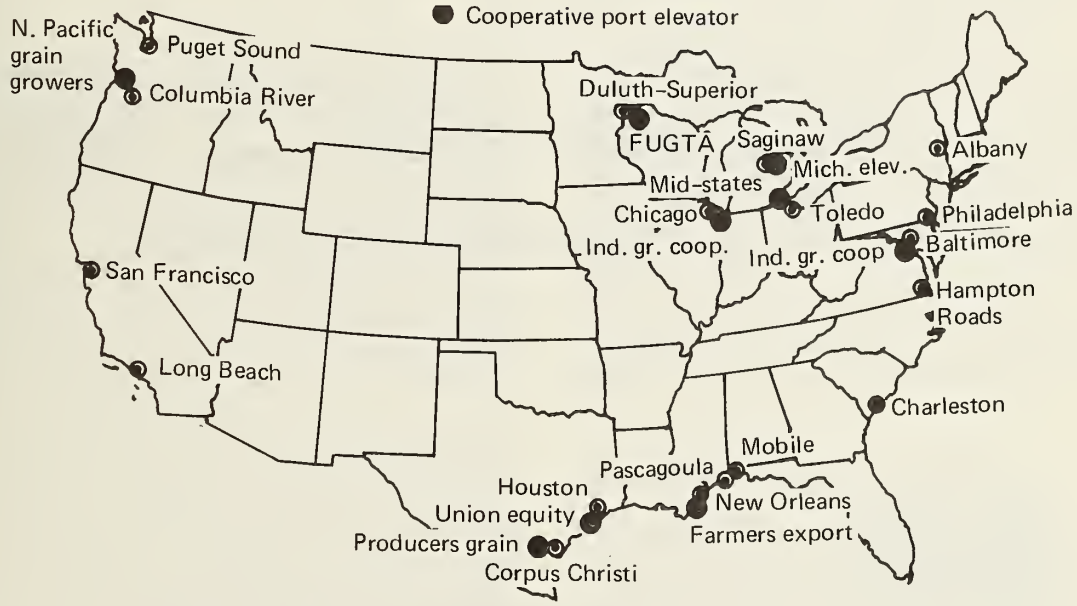


**Figure 2. Major port areas for U.S. grain exports and cooperative port elevators**

## Grain Flows to Port Elevators

The grain flow from inland points to coastal ports for cooperatives is similar to that for the total U.S. export flow because cooperatives have port elevators on every coast. The major exception would be for the Norfolk, Va. and Seattle-Tacoma, Wash., areas where cooperatives do not have port elevators.

Principal wheat export movements are to the Gulf, Pacific Northwest, and Duluth-Superior. Principal feed grain and soybean export movements are to the Gulf and Atlantic coasts.

In 1974, regional cooperatives shipped 870 million bushels of grain to port positions. Of this total, wheat comprised 43 percent, corn 34 percent, soybean 13 percent, and sorghum 9 percent.

The export volume originated for the Pacific coast was 75 million bushels, the Great Lakes 110 million, the Atlantic coast 92 million, and to the Gulf coast 592 million bushels. An approximate breakdown of cooperative volume by mode of arrival at ports was 63 percent by rail, 25 percent by barge, and 12 percent by truck.

## The Co-op Share of Exports

Up to this point, we've talked about the grain (includes wheat, corn, sorghum, soybeans, oats, barley, rye, and flaxseed) export volume originated by 14 regional cooperatives. This 870 million bushels in 1974 represented 26 percent of U.S. grain exports (Figure 4). The volume moved through the 9

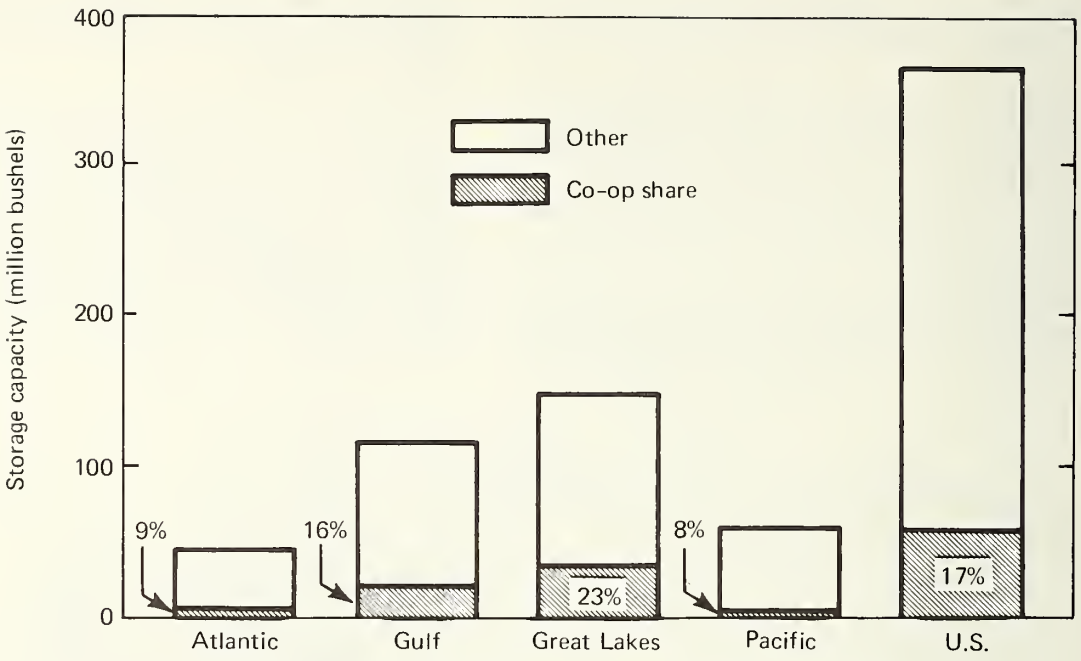


Figure 3. Cooperative port terminal capacity as percent of U.S. total, 1974

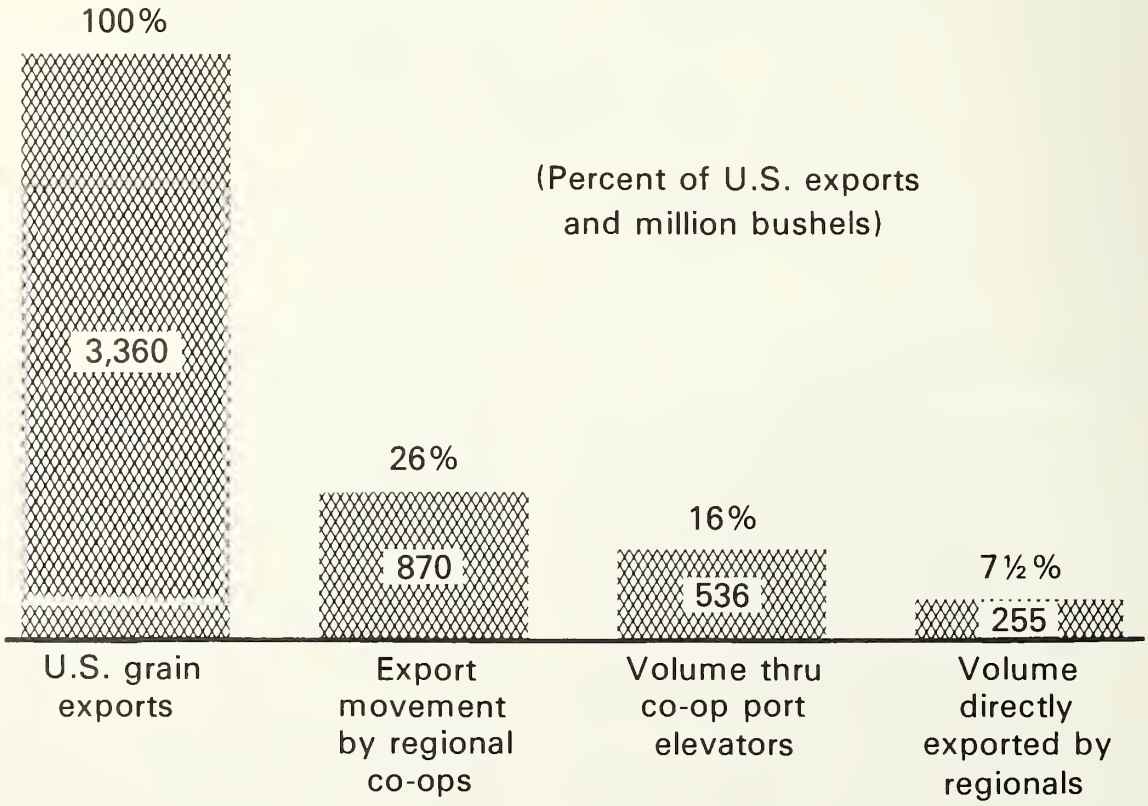


Figure 4. Regional cooperatives' share of U.S. grain exports, fiscal 1974

cooperative export elevators was 536 million, or 16 percent of U.S. grain exports. Of this quantity, 255 million bushels, or 7.5 percent of U.S. exports, represented direct exports by cooperatives to foreign buyers. The remainder was sold to various international grain firms and traders on an F.O.B. basis. Thus, the share handled by cooperatives decreased from the 40 percent handled at the local elevator level to 7.5 percent of U.S. exports sold directly to foreign buyers.

This relatively small direct export volume is shared by several regional grain cooperatives. In comparison, the major grain firms individually have shares of the export volume ranging from 10 to 25 percent.

## PROBLEM AREAS IN COORDINATING MOVEMENTS

In coordinating grain export movements, grain cooperatives face problems common in the grain industry that include peak and valley seasonal movements, port embargoes, grain inspection problems, changing rates and rate relationships, uncertain transportation service, low utilization of equipment, rail abandonments, poor rural roads for grain assembly, and inadequate industry-wide coordination of movements to ports.

Our research in FCS has found that cooperatives have a specific, but not exclusive, set of problems that hinder their optimum coordination of grain export movements, and about which they can do something to improve the situation. We found that cooperatives' problems can be grouped into 5 major problem areas: (1) grain procurement and commitment, (2) grain storage and handling facilities, (3) transportation services and equipment, (4) utilization, and (5) export sales.

### Grain Procurement and Commitment

From the standpoint of the export elevator, "procurement" includes the entire process of assembling grain for export. Our studies show that individual local cooperatives have been successful in grain procurement but the cooperative procurement or assembly system tends to weaken as it progresses from the local elevator to the regional cooperative and port elevators. As previously stated, cooperatives handle about 40 percent of farm grain sales at the local elevator level. In 1974, they originated 26 percent of U.S. export sales, handled 16 percent through co-op port elevators, and directly exported about 7.5 percent.

There are many reasons why cooperatives lose control of substantial quantities of grain prior to export. One might be traced to the lack of market commitment at all points along the marketing channel. Absence of formal commitment results in numerous problems for grain marketing cooperatives. Most relate to the fact that the cooperative cannot determine in advance how much or what kind of grain it will have to merchandise. This lack of formal commitment:

(1) Reduces ability to enter into increasingly common long-term contractual arrangements with both domestic and foreign customers,
(2) Limits ability to participate in large, one-time sales,
(3) Limits information on which to base price decisions,
(4) Hampers long-term corporate planning, and
(5) Causes inefficient use of transportation equipment and physical facilities.

Formal commitments between farmers, their local cooperatives, their regional cooperatives, and their export cooperatives could do much to bring about a coordinated movement of cooperative grain to port areas. In addition, cooperatives should have alternative pricing and delivery arrangements that will meet members' needs and that can provide high grain volume and a more even seasonal flow of grain into market channels. Because members own the cooperative, these objectives can be more easily accomplished by a cooperative than an investor-owned grain firm, if the members really want to do it.

### Grain Storage and Handling Facilities

Grain storage and handling facilities frequently become ineffective because of obsolescence, inadequate maintenance, poor location, or inability to handle increased volume. Cooperatives can increase the effectiveness of export movements by continually improving strategic elevator locations and performance capability.

Because farmers collectively own the physical facilities at all levels, the potential is great for improving the storage, handling, and movement of grain under an overall coordinated cooperative system.

### Transportation Services and Equipment

Frequent shortage of hopper cars and barges and the absence of adequate rail services at many points have made it difficult for cooperatives, as for other firms, to plan and make shipments of export grain. Coordination of cooperative export movements can be enhanced by having (1) alternative transportation modes, (2) trucks where rail services are inadequate, (3) adequate car or barge supplies, (4) frequent service by rail or barge, (5) large shipments, and (6) favorable rates.

Cooperatives can do much to bring about improved transportation services by optimizing location of subterminals and terminals, buying or leasing hopper cars and barges, and working for improved services and rates. We found that, to a large extent, cooperatives have done this, and they can do much more by increasing the joint effort among cooperatives to improve utilization of equipment.

### Utilization

Low utilization of hopper cars, barges and port elevators involved in export movements are frequently major problem areas for cooperatives.

Individually, most of the present cooperative organizations are struggling to attain optimum utilization of hopper cars. To date, some exchange of hopper cars has taken place between grain and farm supply regionals where each will take the cars for a 6-month period or so. Probably the greatest opportunity for improving utilization lies with coordinating the cooperative movements of grain and fertilizer on a larger scale. This would include both back-to-back leasing periods and a two-way hauling arrangement for fertilizer and grain.

Joint effort by regional cooperatives to coordinate available leased hopper cars used in grain and fertilizer shipments could be expected to result in greater utilization of hopper cars, reduce transportation costs, and possibly result in other marketing efficiencies.

Some port elevators owned by individual regional cooperatives are not fully utilized, whereas other regionals do not have access to a cooperative port elevator. New cooperative organizations or agreements between regionals could make it possible to better coordinate grain export movements and increase utilization of cooperative port elevators.

### Export Sales

The nine cooperative export elevators are owned by 8 different regionals. The regionals usually act independently when making export sales. The bulk of their sales are F.O.B. at a U.S. port. Only four regionals make sizeable direct export sales.

They are at a distinct disadvantage in competing in the world grain markets. In comparison to the major exporters, the individual cooperatives lack the following: (1) a good information system, (2) a large supply of all grains, (3) flexibility, (4) overseas facilities and sales offices, and (5) secrecy in operations.

Foreign buyers say they would like to trade with U.S. cooperatives but that they would like to deal with one central cooperative organization who can speak for all U.S. cooperatives and provide prices and supplies for all grains.

If cooperatives are to become a viable competitive force in grain export marketing they should find ways to coordinate their sales to foreign markets. By doing this they would be able to speak with one voice to potential foreign buyers and offer them the kind, quality, and quantity of grain desired from various U.S. ports.

## WORK OF FARMER COOPERATIVE SERVICE

FCS has been involved in considerable research to improve the transportation effectiveness of cooperatives (for examples, see 1 and 3). Based on studies we've conducted, we're increasingly convinced that cooperatives should mold their transportation system to fit their needs if they are to efficiently export grain.

How can cooperatives mold a transportation system to fit their needs? *Control* is the key. Some way, somehow, a substantial part of the physical transportation function must be controlled by the shipper. Otherwise the transportation system could be dictating how, when and even where cooperatives might move their export grain to market.

Findings of studies we've conducted tend to support this thesis and show the desirability of coordinating use of transportation equipment among firms.

For example, in 1971 we conducted a study to determine possibilities for coordinating southbound flows of grain by barge for export with the northbound flow of farm supplies to improve service and reduce costs. The study concluded that joint operation of a private fleet of barges and towboats by cooperatives contiguous to the Mississippi river system showed a sizeable potential for reducing transportation costs.

Early in 1974, five regional grain marketing cooperatives and a fertilizer distributing cooperative purchased the assets of Rose Barge Lines, St. Louis, Mo., consisting of seven towboats and over 200 hopper barges and began operations to barge fertilizer ingredients northbound and grain southbound to the Gulf. Since that time, the new co-op barge line—Agri-Trans—has increased its fleet of barges and towboats as business expanded.

The co-op's own barge line assures members an adequate supply of equipment when needed at a reasonable rate. But, most importantly, the cooperatives have been able to mold the barge line's services to meet their individual needs. Or, as an executive of Agri-Trans stated it, "for the first time, the American farmer through his cooperative, *controls* the movement of needed supplies to his farm and the shipping of his products to market."

A similar type of opportunity exists for coordinating use of rail cars. Recently, we initiated a study to determine possibilities for improving utilization of

rail cars operated by cooperatives. We estimate co-ops presently own or lease over 9,000 cars, mostly covered hoppers and tankers. Most of these cars are used on a one-way haul basis and poorly utilized during off-season or slack periods.

Cooperatives are not unique in operating rail cars. Most of the large grain and fertilizer firms have fleets of cars. Why is shipper operation of rail cars necessary? There is no alternative for tank cars. The railroads do not furnish such equipment, so the shipper supplies his own needs. Shortages of covered hopper cars in recent years forced shippers to obtain their own to assure themselves a supply of such cars when needed.

So far, we have obtained data from 14 regional grain and farm supply co-ops. They own or lease 5,000 covered hopper cars and 3,020 tank cars. Five of the co-ops own or lease 500 or more cars, six have 100 to 500 cars and three have fewer than 100 cars.

Preliminary analysis of data indicates car utilization is extremely low with lease costs greatly exceeding car earnings from railroad mileage allowances. Despite the staggering costs to shippers for operating their own cars, all of those studied say they have no alternative. If this is indeed the case, and we have no basis to doubt it, then some method must be devised to get better car utilization and car earnings for cooperatives.

In regard to improving rail utilization and car earnings, we suggest that cooperatives study and consider the following:

1. Development of an inter-cooperative, coordinated pool car program for cooperative owned or leased rail cars to improve utilization by matching off peaks and troughs of demand.
2. Location of grain and fertilizer facilities in the grain producing areas near each other to facilitate two-way loaded movement and achieve greater utilization of hauling equipment.
3. Possibilities for service and rate incentives by carriers that would encourage shippers to develop programs to coordinate two-way loaded movements of grain and fertilizers.
4. Leasing of locomotives to achieve greater control of movements, and thereby increase cooperatives' car utilization, improve car scheduling to match loading times of ships, and increase port elevator utilization.

## WHAT HAVE COOPERATIVES DONE?

Cooperatives have made only moderate progress in coordinating export movements.

### Formed Farmers Export Co.

Probably one of their best efforts through joint action was the formation of Farmers Export Co. by 7 regionals and the construction of a port elevator at Ama, La. in 1968. This permits centralized control of export sales and movements of a significant volume of export grain.

### Purchased Barge Line

In July 1974, 5 grain regionals and a fertilizer distributing cooperative set up a new cooperative, (Agri-Trans Corp.), which barges grain downriver and fertilizer materials upriver. (Discussed in more detail earlier in this paper).

### Other Efforts

Regionals have built a relatively strong base for further coordination of movements by individually acquiring 9 port elevators, many inland subterminals and river terminals, and hopper car fleets. They have pressed for more favorable transportation rates and service. And more recently 3 regionals have initiated marketing agreements. All of this represents progress, but much more can be done.

## WHAT CAN COOPERATIVES DO?

If cooperatives are to maintain their position and grow they must take further steps to improve the coordination of their grain movement system. Our suggestions for improvement have been stated already or implied. In closing, we shall summarize our suggestions for improving efficiency and adding to farmer returns into 4 important areas:

1. Develop an export procurement and commitment program that includes all cooperatives.
2. Provide for flexibility in use of all co-op port facilities.
3. Centralize co-op export sales into one organization.
4. Provide for centralized coordination of co-op transportation equipment and movements.

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# Discussion

DR. HILL: We have heard three very good, stimulating, provocative papers. We will open it up now for some questions.

MR. REID M. GRIGSBY (Department of Agriculture, Louisiana): For any of the speakers, why is it, with all of these potential efficiencies to which you have alluded as possible, that with just one sweep of the brush the longshoremen can wipe it out over night?

DR. JONES: I will just comment that this is another indication of one of those policy areas which in my opinion does need greater attention on the part of the economists. As for an answer, I can't give that.

MR. THURSTON: I might comment that it might be people and systems. We need better people instituting better systems. That is a very short answer.

MR. MIKE SCHOFIELD (Maritime Administration): As some of you know, the Merchant Marine Act of 1970, which provided for increases in American flag shipping, also paved the way for the National Maritime Council, which is a coordinated organization of all the sectors of the American maritime industry including labor, seagoing and shore-based, and since that time there has not been one major work stoppage by the longshoremen or any labor union connected with the maritime industry.

We believe that this will continue and we have had assurances from the high people with the longshoremen as well as the seagoing unions that they are prepared to continue this, too. However, they do have some projects that we think the administration will have to cope with in terms of increasing the support by American shippers of the American merchant marine.

MR. STANLEY K. SEAVER (University of Connecticut): Is there any data or any study that has been made that indicate how much savings in transportation we could achieve by coordinating the demands in our international market?

It seems to me that the international buyers, and I can understand this, want delivery whenever they want it. Isn't it possible that you could use your railroads and your barges and your ships much more efficiently if you could send out one shipload of wheat or whatever it is from New Orleans once every week, once every day, instead of hitting these peaks and valleys? It seems to me that we have got a lot of excess capacity in order to get all the grain out in three months.

MR. SWANSON: Well, first, I think that in fact demand is considerably more constant than it was at one time, just as there is now the absence of the peaks and valleys in domestic transportation. I don't think we saw a peak this fall anything near to what we did last fall or the fall before. I think the whole system is tending to straighten itself out considerably from what it has been in years gone by. I guess that I would have to say that we are working in that direction right now.

DR. HILL: Stan, do you want to add anything more to that?

MR. THURSTON: Well, I might say from the standpoint of cooperatives, they, too, are attempting to iron out their seasonal movements by scheduling their sales and planning their sales ahead. They need to do more of this. It is very difficult to do this domestically if we have foreign buyers who all of a sudden slap us with large orders or large purchases, so a lot of this is dictated by the buyers and the unpredictability of their demands.

MR. J. W. PENDLETON (Zapata-Haynie Corporation): We are a menhaden fishing company and our biggest problem that the gentleman over here was talking about is storage facilities. We are also a seasonal operation, sort of like the grain industry. Seemingly we catch everything along about June, July and August, and we just can't find storage facilities to maneuver our shipments the way we would like to, either, so storage is part of the problem, rather than just the shipping.

MR. DONALD F. REHL (CONRAIL): Most of the conversation here has been devoted pretty much to the Gulf ports. We would like to remind you also there are some ports on the East Coast from Albany to Norfolk. While you have the opportunity to supply the Gulf Coast ports or the elevators with either rail or barge and I presume to some extent truck, all of that grain that moves from the Midwest to North Atlantic ports is going to have to move by rail with the exception of a very small percentage that comes into the various port elevators on the East Coast by truck. It has to move in a rail car which poses somewhat of a different proposition for those exporters on the East Coast or the North Atlantic ports, as we call them, than you have at the Gulf ports.

Due entirely I am sure to the tremendous volume handled by Gulf versus either the Lakes or the North Atlantic, we have an entirely different problem transportation-wise than you have for the Gulf. About 60–65 percent of the originated grain on CONRAIL is in export movement; about 60 percent of that moves in unit trains, so what I am saying to Mr. Swanson, with unit trains consisting of 25, 54, 75 or 115 cars, he has already indicated he thinks this is a better mousetrap to get the grain into the export market, and I am wonderiing where Mike sees this going. We are wondering the same thing and hopefully we on the North Atlantic will not be inhibited by a service order this fall.

DR. HILL: All right, I think that poses a ques-

tion. Let me just add to it, if I may, Mike, before you try to answer it. We probably have 30 or 40 elevators in Illinois now handling unit trains. That could be expanded. I am not sure how far it is going to go, and if they each have to get 45 trains a year, what does this mean in terms of the total shipment and its destination. Every elevator can't have a unit train. To restate Don's question, how far will the trend to unit trains go?

MR. SWANSON: That's a good question. I wish I could answer it for you. Through unit trains you end up considerably increasing the available cars to the country shippers. There has to be a balancing of the equity and efficiency, which means that I feel relatively sure that the Commission is going to maintain some number of cars in unit train service. I don't know what that magic number may be this year. There are proceedings before the Bureau of Enforcement right now that could result in anything from totally abolishing the consecutive movement portion of unit trains to the other extreme that we have seen the last two years, which was that of limiting to maybe 20 percent the number of cars to be devoted to unit train service.

I hope that we are going to continue to see at least 20 percent of the hopper car fleet in unit trains and we will probably see that 20 percent of the cars moving 50-plus percent of the grain because of the efficiencies. Hopefully, as the agricultural marketing system becomes more sophisticated, you are going to see more and more sub-terminal type operations that can take advantage of unit trains and less and less of the single-car type shipper. I can foresee increased use of sub-terminals and unit train services. It probably happened in the eastern cornbelt before it did in Iowa—at least the "rent-a-train" was first authorized in the Eastern Territory.

I think it is going to rectify itself but it requires a kind of evolution.

MR. C. WARREN GREEN, JR. (Virginia Department of Agriculture): We do have some very fine ports up there on the North Atlantic and we hope we continue to have them.

My question is to you, Mr. Swanson. You alluded to cheaper rates by the railroads. We had a proposal by the Southern Freight Association and I think they held the hearing on the 10th of November dealing with "peak demand" rates. Now, you haven't addressed that. As you know, the ICC was mandated by Congress in the 4-R Act to develop these rates. What are your comments on that and what do you see for the future. My view is that this is going to affect certain industries in Virginia and a lot worse than others.

MR. SWANSON: The Interstate Commerce Commission—I think the docket number is ICC-324—is investigating this seasonal or peak demand type rate. I see from the standpoint of the grain industry itself some reluctance in total to these peak demand prices. In fact, the railroads are competing with all of the barge lines and the truck lines that are completely unregulated. Much of this unregulated transportation is on contract-type movements whereby they enter forward contracts for the equipment as well as the particular rate level. What seems to be contemplated for the railroads, at least on this peak demand-type pricing, is rates that would be allowed to fluctuate on much shorter notice and I suppose that scares a lot of people. I guess that there is enough emphasis on deregulation that we are going to see it to some degree.

At one time the Department of Transportation was very strong on wanting the area of grain transportation to be the guinea pig on deregulation of the railroads, so to speak. We have not heard comments like that for some time and now I guess we are all going to have to wait and see what happens next year. We may be playing a whole new ball game on deregulation.

MR. BRUCE A. CONNELL (Interstate Commerce Commission): I may be able to shed more light on Ex Parte 324. Mr. Swanson is correct in his assumption that it is deregulation in a sense, that the ICC is not proposing to establish rates per se but instead it is proposing to permit more flexibility for the railroads to institute rates. As Mr. Swanson mentioned, one of the major proposals is to allow short notice cancellation of rates that aren't working and short notice innovation of rates; that is, to get them into effect to see if they work and to get them out if they don't work.

Now there is an offsetting problem, of course. When you are leveling out the peak demand for transportation, you have an offsetting cost of increased storage to take advantage of this leveling out. The offsetting factor against short cancellation is the investment that the shippers have to make in storage. But, as I say, the ICC is not creating these incentives. They are permitting the railroads to take the initiative and trying to provide flexibility to the railroads while at the same time protecting the shippers.

MR. ROBERT FETTER (Southern Railway): I would just like to comment briefly on this shipper hearing held at Southern Freight Association, on this question of grain rates which the gentlemen from Virginia asked about. The grain companies themselves pointed out that we have barge rates which can fluctuate a great deal—there may be an understood scale and I am not an expert on the grain rates on the river—as a matter of fact, they will vary from 60 percent to 250 percent of a given scale, whereas the type of fluctuations we are talking about during peak sessions for the railroads are much smaller than that.

MR. EDWARD W. TYRCHNIEWICZ (University of Manitoba): Mr. Thurston, you mentioned that there was a need for greater control and coordination in the movement of grain by the farm co-ops. I just wanted to raise the possibility of maybe looking

at an agency similar to the Canadian Wheat Board, which exercises considerable control over the movement of grain. Now I fully appreciate that philosophically the U.S. isn't too enthusiastic about the centralized marketing agency, but the Canadian Wheat Board does provide a number of other coordinating functions like the allocation of rail cars and the issuance of shipping orders.

Have you given any thought to that kind of approach?

MR. THURSTON: No, not to any great extent. We do realize that marketing boards are very popular up there and I think that in the next few years we may be investigating this area to a greater extent, but I think it takes an educational process to bring such a system into existence.

MR. SWANSON: I have been led to understand that sometime this year this question is going to come up again as to whether the Canadians want to continue under the Wheat Board type system or not, is that true? Does somebody want to answer that?

MR. TYRCHNIEWICZ: Yes, the point to which you are referring concerns the marketing of domestic feed grains. There are now both systems at work. The Canadian Wheat Board, which markets feed grains internationally, has exclusive control over international marketing but it is also involved in the domestic marketing of feed grains in competition with the private grain trade. That plebiscite will be coming up, I think, within 18 months or so, but it won't mean the demise of the Wheat Board necessarily, although some people would like to see that.

MR. RALPH O. AVERY (Burlington-Northern Railway): I would like to comment on the relationship or the adoption of the Canadian Wheat Board system in the U.S. We do have something in the U.S. that resembles the Canadian Wheat Board system; we call it the U.S. Post Office.

But I would like to say this in all fairness. Canada exports a large quantity of wheat and a small quantity of barley and that is about it. We export a little better than two billion bushels of wheat, a billion five of corn, about a quarter-billion of soybeans, and we do it off the North Coast, the South Coast, the East Gulf, the West Gulf, the Great Lakes—I wouldn't want to forget my friends of the Pennsy—the Atlantic Coast. I think if we had an operation like the Canadian Wheat Board, we would end up with a lot of wheat around Des Moines someplace.

DR. HILL: Let me summarize Session A, as I view it.

The preceding papers show that a lot of research has been done, both privately and publicly, on transportation of grain in world markets. We have cost data on alternative transportation systems, although perhaps it needs some additional work and refinement. The economic criteria on which firms make their choice of transport route and mode is also fairly well known. The flow of products overseas through each of our major ports is well documented. There are studies under way, looking at the logistics of movement through these congested ports.

Yet we are still unable to provide answers to several important questions. Let me just identify a couple of these as illustrations.

Number one, what will be the effect of changes in export transportation rates on export prices, on local supplies, and upon the quantity of transportation provided by other modes of transport?

Number two, what is the effect of subterminals and large volume export rates on the prices paid by processors or paid to farmers back in the surplus production areas?

Number three, what is the effect of the high degree of industry concentration in grain exports? A recent publication by Farmer Cooperative Service suggests that five firms control about 85 percent of the U.S. export market. These firms are generally vertically integrated, both forward and backward, with heavy involvement in the export of other countries' grain. Does this market structure limit the ability of co-ops to enter the export market?

There was talk even before this meeting of a central government agency to negotiate U.S. grain sales to foreign countries. Aside from the philosophical questions of the free market, what would be the economic effects of a government monopoly of the export business? Can we make comparisons of getting more competition in the business, less competition in export control, and a central planning agency on the performance of the grain industry?

Lastly, what transportation policies and regulations increase the logistical efficiency of moving grain from producer to export market?

The answers to these questions require research of a different nature and magnitude than we have been discussing. First, the needed research should integrate the political, the economic and the engineering theories and knowledge.

Second, the scope of the research must be extended to include more of the important variables. Too many models fix the transportation rates and settle for an optimum, or fix prices and quantities and search for an improved routing, or accept existing patterns of seasonal storage and marketing in a model that seeks to reduce peak transportation demand. These variables are simultaneously determined and must be included simultaneously in the models.

Third, we need to extend and develop the theories that will explicitly include a very complex ocean freight rate into our models of international trade.

Perhaps the challenge exceeds our research ability, but policy decisions in transportation are being made by government and by firms with or without research input. They will be made whether or not researchers can quantify all of the effects but we cannot justify continued repetition of existing models without looking at the questions and taking them into account in our research.

# Luncheon Keynote Address Issues in Evaluating Transportation Regulation*

A. F. Friedlaender
Professor of Economics and Civil Engineering
Massachusetts Institute of Technology

## SETTING OF THE PROBLEM

In recent years a number of economists have attempted to quantify the costs associated with regulating the surface freight transportation industries. While the measures vary with the specific kinds of regulatory costs studied, the methodology used, and so forth, virtually all academic economists agree that these costs are substantial. Most recently, Thomas Moore has estimated that in 1968 these costs ranged from a low of $4 billion to a high of $8.8 billion annually (4). In view of the inflation in recent years, these costs would be considerably higher now.

If correct, these figures indicate that there is a considerable social cost associated with current regulatory policies and that regulatory reform should be a high priority item of any Administration. In fact, a modest step toward deregulation was made when the Railroad Revitalization and Regulatory Reform Act became law last spring. This, in conjunction with the passage of trucking regulatory reform, could have a major impact on the structure of the surface freight industries.

Of course, all efforts toward deregulation will now enter a holding pattern until the intentions of the Carter Administration become clear. Moreover, even if the Carter Administration ardently embraces regulatory reform and deregulation, it is clear that serious efforts toward deregulation would meet with considerable skepticism if not hostility in Congress. In the past 15 years, a fairly predictable pattern of political behavior has evolved with respect to deregulation. Butressed by the arguments of academic economists, the Kennedy, Nixon, and Ford Administrations have each drafted far-reaching legislation aimed at reducing the role of regulation in the transportation industries. Hearings have then been held, in which a large number of representatives from specific shipper groups, industry groups, and labor groups have testified about the specific damage that deregulation would impose upon them. As a counterweight, academic economists have then testified about the general efficiency losses imposed upon society by regulation.

Since the representative of the particular shipper, industry, or labor groups can point to specific real (or imagined) losses and since the academic economists can only point to the general good, it is not surprising that their arguments have met with polite (and occasionally impolite) indifference on the part of legislators concerned with drafting transportation legislation. However, the problem is more than one of simple communication. Indeed, I will argue that the economic models that have generally been used to evaluate the costs of regulation are sufficiently unreal that it is not surprising that economic arguments have generally been discounted in the political arena. Moreover, I will also argue that the goals of regulation have encompassed considerably more dimensions than economic efficiency. Thus it is not surprising that highly simplistic economic analyses stressing aggregate efficiency losses have received relatively short shrift; on the contrary, it is surprising that they have received as much attention as they have.

## THE ECONOMIST'S ARGUMENT

While something of a caricature, existing analyses of the costs of regulation have tended to make the following assumptions: (1) Income is optimally distributed so that all individuals have an equal welfare weight; (2) in the absence of regulation, the transportation industries would reach the competitive equilibrium where $p = LRMC = LRAC$; (3) the long-run "supply" curve of the transportation industries is horizontal.

Under these assumptions, it is an easy matter to calculate the deadweight loss associated with regulation if the regulated price is greater than long-run marginal cost (1). It is also an easy matter to estimate the resource costs of shipments not going by the low cost mode (2). While somewhat more difficult, it is possible to estimate the cost savings that would arise from having the transportation industries produce along their efficient long-run cost curve instead of

*Editors' note: Topic suggested by Planning Committee was "The Economist's Role in Transportation Policy: Design and Measurement of Impacts."

**Nan Friedlaender gives keynote address. Others in view at table are Joe Gerald (Chairman of Keynote Session), Lowell Hill, Bill Manley, and Orlo Sorenson.**

their inefficient short-run cost curve (3). By summing these costs over industries, it is possible to reach figures on the order of $5–10 billion per year.

Within the context of these assumptions, there are a number of complex methodological issues, which I will not dwell on here. More basically, however, it should be clear that these assumptions are sufficiently unrealistic to make the resulting analyses largely irrelevant. In particular, since income is certainly not optimally distributed, it is necessary to consider the distribution of the costs and benefits of deregulation. Moreover, since it is highly unlikely that the behavior of the unregulated transportation industries would approach the competitive norm, an analysis based on long-run supply curves and competitive behavior is inappropriate. Finally, since the output of the transportation industries is multidimensional by its very nature, it makes little sense to measure cost or supply curves in terms of a single output measure such as ton-miles or passenger miles.

Consequently, if economic analysis is to make a contribution to the debate concerning the merits of regulation, it seems clear that the entire framework of the analysis must be recast to ensure that it is conducted in a more meaningful context. This means, in particular, that the economic analysis used to evaluate the impact of deregulation must be considerably richer than that used to date. Moreover, it must pay considerably more attention to the very real distributional goals that regulation has addressed. Indeed it is my belief that the behavior of the Interstate Commerce Commission can be explained in terms of the ICC's efforts to maintain a rate structure that favors agricultural and rural interests. Thus, efforts to evaluate the impact of deregulation that fail to address this distributional issue will be relegated to yet another seldom-visited shelf of the library.

While something of an oversimplification, one can make a convincing argument that the ICC has generally been more concerned with issues of the income distribution than with issues of economic efficiency. To this end, in making decisions with respect to rates, entry, or merger, it has tended to stress questions of income losses to specific shippers or carriers rather than questions of resource savings. Thus, as exercised by the ICC, regulatory practices have more been vehicles for social justice as defined by the ICC than vehicles for ensuring economic efficiency. In particular, the ICC has tended to weigh the interests of agricultural and rural areas, small towns, and existing carriers more than the interests of the urban or suburban consumer.

Thus, in deciding on the merits of a relaxation of rate regulation it is necessary to decide the following:

(a) Are the distributional goals implicitly followed by the ICC socially desirable in view of the realities of the late Twentieth Century?
(b) If so, is regulation a desirable means to achieve these ends?
(c) If a major change in policy is contemplated, will the magnitude of the losses to specific groups be substantial, and if so, can we adopt policies to ameliorate these costs?

Although the first two questions are clearly of major importance, their answers almost certainly lie beyond the realm of economics. Thus, I would like to focus on the third question; namely the perceived and actual costs and benefits of deregulation to specific groups.

This last question is probably crucial. While there

is considerable controversy about the magnitude of the changes in the rate structure that would be occasioned by deregulation, the conventional wisdom holds that under deregulation rates to agricultural and rural shippers in the West and Southwest would rise; rates to small towns might rise while service would decline; and rates on manufactured and bulk commodities would fall. Thus, it is widely believed that a policy of rate deregulation would probably help consumers and manufacturers in large urban and suburban communities and hurt rural and agricultural interests. Thus, unless it can be demonstrated that these losses are illusions, serious efforts at deregulation would meet considerable opposition by rural and agricultural interests. In addition, in view of the evidence concerning cost differentials of regulated and exempt carriage, conventional wisdom also holds that deregulation would reduce the profitability of trucking firms or their ability to maintain high teamsters' wages. Consequently, teamsters have been particularly vocal in their opposition to deregulation.

On balance, the issue of the merits of rate deregulation probably depends on one's assessment of the relative merits (both political and social) of competing interest groups. Virtually all students of the problem estimate enormous resource savings in lower rates and more efficient utilization of capacity arising from deregulation (on the order of $10 billion annually). But this is not costless since it is quite likely that agricultural, rural, and trucking interests would be hurt by deregulation.

The ICC's behavior with respect to entry and merger in the trucking industry can also be explained by its desire to maintain the traditional rate structure. In general, the ICC has tended to discourage entry and to acquiesce to (if not encourage) mergers in the trucking industry.

A "plausible" scenario of free entry into the trucking industry could be the following. As trucking firms enter the industry, a period of unbridled competition would take place in which trucking rates would fall substantially. Responding to competitive pressures, railroads would then have to reduce rates. Since, however, the railroads would then lose their return on high-valued manufactured goods, they would attempt to maintain profitability by raising rates on non-competitive agricultural and bulk commodities. This, of course, would cause a fundamental shift in the rate structure, with the consequences discussed above.

Alternatively, we can argue that free entry would not lead to substantial rate reductions in the trucking industry but to increases in service. From the point of view of the maintenance of the existing rate structure, however, increases in trucking service could be just as damaging as reductions in trucking rates since service improvements could also cause substantial diversion of rail traffic and concomitant upward pressure on agriculture and rural rail rates.

In addition, increased entry in the trucking industry could reduce profitability and thus increase resistance to teamsters' wage increases.

Thus, it is widely believed that free entry in the trucking industry would probably have many of the same effects as rate deregulation: Rates on manufactured articles would fall, rail profits on manufactured goods would fall, trucking profitability and teamsters' wages would fall (relatively if not absolutely), and agricultural and rural rates would rise. Thus, relaxation of entry restrictions in the trucking industry is generally viewed with as much suspicion as relaxation of rate regulation. It is widely believed that either policy would lead to a major loss in real income to agricultural and rural interests.

Consequently, serious efforts at regulatory reform must be accompanied by efforts to assess the distributional impacts of deregulation. In the absence of such an analysis, I do not believe that deregulation is politically viable.

## A POLICY MODEL OF THE TRANSPORTATION INDUSTRIES

Having outlined the need for regulatory analysis to encompass distributional variables, let me now turn to some work that we are doing at MIT which will hopefully provide some of the answers to these questions in the not too distant future. During the past year we have developed a number of linked models that can be used to quantify the magnitude of various distributional effects of a change in regulatory policy as well as to quantify the magnitude of its efficiency effects.

The basic premise of the analysis is that relative prices matter. Thus any change in transportation regulatory policy should lead to a change in the transportation rate structure, which in turn will affect a wide range of regional and national variables concerning income, output, employment, etc. Since these, however, can influence transportation costs and/or demands, the entire system is interrelated and simultaneously determined.

These propositions can be analyzed with the help of the following four linked models:

- A regional transportation model that determines costs, revenues, profits, outputs, shipment characteristics, rates, and factor demands by firm, by mode, by broad commodity type and by region.
- A regional income model that determines factor prices, consumer prices, incomes, outputs and employment by broad commodity type.
- A national interindustry model that determines interindustry coefficients, commodity prices, commodity outputs, and factor employment by broad commodity type.
- A small-scale national macro-econometric

model that determines factor prices, final demands, and consumer prices.

With the exception of the exogenous variables in the national macro-econometric sub-model, every variable that is exogenous to a given sub-model is endogenous to another sub-model. Hence, the entire system is interrelated and interactive; a full solution to the model must be simultaneously determined.

In terms of policy analysis, we can postulate a change in transportation policy that affects costs, demands or the nature of market equilibrium in the transportation industries in a given region or the nation as a whole. This, in turn, affects transportation rates and factor employment which in turn affect regional and national outputs, employment, factor prices and so forth. However, these in turn affect the nature of the equilibrium in the transportation industries. Thus by using these interrelated models, we can analyze the impact of a wide range of transportation and related policies upon a wide range of variables that measure distributional as well as efficiency impacts.

To make the problem tractable, our initial efforts will be quite aggregative and deal with broad categories with respect to modes, regions, commodities and factors. We thus plan to consider the following:

*Modes*.—Initially we plan to focus upon the rail and trucking industries. Because of data limitations, we will probably have to confine our analysis to regulated trucking, although it would obviously be desirable to extend it to private and exempt carriage.

*Regions*.—At this time we are primarily interested in developing an integrated model that can be used for aggregative policy analysis. Consequently we plan to limit ourselves to the five ICC rail regions: The Official, Southern, Southwestern, Western Trunk and Mountain Pacific. Once we have this aggregative regional model working, we can always extend the analysis to more regions.

*Commodities*.—Although a wealth of commodity detail exists, for reasons of tractability, we plan to limit our initial analysis to the following broad commodity groups: durable manufactures; nondurable manufactures; feed grains, other agricultural products; coal; petroleum and petroleum products; minerals, chemicals and others.

Our basic approach is one of comparative statics with transportation regulatory policy as the primary exogenous variable. We thus determine an initial equilibrium and postulate a change in transportation policy. After determining the new equilibrium as well as its time path, we can then assess the impact of the policy change.

Our main analytical tools are changes in the cost functions, changes in the demand functions, and changes in the nature of the market equilibrium in the transportation industries. These permit us to consider a wide range of policies under a wide range of situations.

With respect to industry behavior, we can analyze the nature of the equilibrium if the transportation industries operate under joint monopoly profit maximization, workable competition, or oligopoly or monopolistic competition. We can also analyze how the equilibrium would change if transportation firms were to maximize objective functions other than profits.

Within this framework, it is relatively straightforward to analyze regulatory policies that affect rates or costs. In particular, we should be able to assess the impact of the following: deregulation under different market structures; marginal cost pricing; abandonment and capital adjustments; work force adjustments; entry restrictions; and abolition of rate bureaus. Moreover, insofar as energy policies affect final costs, our analysis should be able to assess their impact. Finally, this framework can also permit us to assess the impact of user charges and investment or promotional policies that affect carrier costs.

**Wilbur Williams listens to Nan Friedlaender describe interactive economic models**

To recapitulate briefly, these interrelated models permit us to analyze the impact of a wide range of transportation and related policies upon a wide range of variables that measure distributional as well as efficiency impacts. Specifically, by utilizing this framework, it should be possible to consider the following:

*Transportation Policies*

- Setting rate levels or rate bands in the regulated transportation industries.
- Total deregulation of rates.
- Elimination of rate bureaus or other forms of cartelization in the regulated transportation industries.
- Relaxation or tightening up of restrictions concerning entry in the regulated transportation modes.
- Relaxation or tightening up of restrictions concerning mergers in the regulated transport modes.
- Relaxation of restrictions concerning abandonment and capital adjustments in the transportation industries.
- Relaxation of restrictions upon the utilization of labor in the regulated transportation industries.
- Construction and maintenance of transportation infrastructure and its related user charges.
- Explicit subsidies for specific kinds of transportation services.
- Energy policy insofar as it affects relative fuel costs in the transportation industries.

*Efficiency Variables*

- Long-run and short-run marginal costs of different outputs by different modes.
- Price-marginal cost ratios for different outputs and different modes.
- Resource cost savings from "optimal" adjustments in capacity and labor utilization.
- Resource savings (or costs) associated with traffic reallocations resulting from competitive, monopolisitc, or oligopolistic market structures as opposed to the present regulatory environment.
- Measures of productivity by transport mode.
- Measures of industrial concentration by transport mode.
- Measures of profitability, costs and revenues by firm and by transport mode.
- Measures of factor utilization (employment) by firm and by transport mode.
- Measures of aggregate level of service by mode.

*Distribution Variables*

- Traffic allocations and profitability by firm and by mode.
- Employment and wages by firm and by mode.
- Employment and wages by national industry, regional industry, and by broad geographical regions.
- Price-marginal cost ratios by class of user and by geographical region.
- Income levels by broad geographical regions and by national industry.
- Producers' prices by broad industry category.

Obviously, a model of this scope and magnitude is not an easy task. We have been working on it for slightly over a year now and have estimated a number of its pieces. However, the full estimation and synthesis of such a model for policy evaluation is still a number of months away.

Nevertheless, we have performed sufficient analysis, particularly with respect to the trucking industry, to permit us to make some tentative evaluations of the conventional wisdom concerning the impact of rate deregulation. Specifically, our analysis indicates the following with respect to the trucking industry:

> When output is adjusted for quality, average costs are virtually horizontal over the relevant range.
>
> The actual output and rates in the trucking industry are respectively only slightly below and above those that would occur under a perfectly competitive market structure.
>
> The cross elasticity of demand for rail and truck transportation of manufactured commodities is significantly less than one.

While the full inferences to be drawn from these facts must await a more complete analysis, it is nevertheless possible to draw the following tentative conclusions from them.

First, if the trucking industry is already competitively organized, little change would occur if the industry were deregulated or free entry were permitted. Hence there seems to be little grounds to the fear that changes in policies with respect to rates or entry in the trucking industry would lead to lower rates on manufactured goods and lower profits and wages in the trucking industry.

Second, if trucking rates and service levels do not change in response to deregulation, there would be little impact on the allocation of traffic between rail and trucks and thus the traditional rate structure. Consequently, while deregulation of the trucking industry might not lead to many efficiency gains, it also might not lead to the feared distributional losses. Hence, deregulation might not lead to such dramatic changes as both its critics and proponents believe.

Third, the low elasticity of demand for rail services on the part of manufactured goods indicates that the railroads are probably presently charging less than the profit-maximizing rate for these commodities. Hence, if the railroads maximized profits in the event of deregulation, it is entirely possible that we would see increase in rail rates on manufactured commodities rather than reductions. In any event, in the absence of pressures to reduce rates on the part of the trucking industry, it is unlikely that rail profits or their high-valued traffic would fall. Hence pressure to raise agricultural rates to offset losses on manufactured commodities are probably exaggerated. While rates to agricultural and rural regions might rise in response to normal profit-maximizing pressures, it is questionable whether these pressures would be exacerbated by a desire to make up losses on manufactured commodities.

In sum, a *very* preliminary analysis has already raised a number of questions about the premise held by the conventional wisdom. Of course, a full evaluation must await a full calibration and estimation of the model. Nevertheless, by bringing the distributional issues explicitly out into the forefront, we have, I hoped, structured the problem in a way that will yield more meaningful answers to policy issues than have those analyses that have been previously available.*

*Editor's note: Time did not permit discussion of this keynote address.

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**John Meyer awaits question from Wes Kriebel as Ken Casavant, Orlo Sorenson, Andy Daughety Arvin Bunker and others listen**

# Session B: The Impacts of Transportation Regulation on Agriculture

William T. Manley, *Moderator*
Assistant Administrator of the Agricultural Marketing Service,
United States Department of Agriculture

## OVERVIEW OF SESSION

The papers and the discussion to be presented on the topic of transportation regulation are of particular concern to me and to my colleagues in the Agricultural Marketing Service because we consider one of our most important and unique functions in AMS to be that of representing the Secretary of Agriculture and hopefully the agricultural community in the actions and proceedings of the Federal Transportation Regulatory Agencies. I can tell you that the task of trying to meet this important responsibility has been anything but a dull one in the past few months.

Our efforts have been made considerably more challenging by the passage of the Railroad Revitalization and Regulatory Reform Act, and it is these kinds of recent developments in the transportation and regulatory arena that make this symposium so appropriate and so timely.

The impacts of transportation regulation on agriculture is not a new issue, nor is it a cut and dried case that has been heard and decided. Perhaps the one certainty that we are dealing with this afternoon is the fact that we are dealing in a controversy that has tremendous implications to agriculture and to rural America, and the real test of the success of this week's conference is not so much what we as professional people learn but rather the positive impact that these scholarly investigations have on the ability of the transportation industry to better serve the needs of agriculture and rural America.

Transportation in the United States has always been a mixed and a complex system. Even the methods for early development were highly variable. The significance of this cannot be overstated. For example, a lot of the sizeable projects in the early 19th Century, including the river canals, were public works. On the other hand, merchants, bankers, industrialists and land developers who were the pioneers of the early American railroad system chose to do it themselves. In this light it is ironic that this same attempt at private enterprise was also the occasion for the first article of legislative regulatory action.

In the 1800's, as you know, the railroads were often the sole means of transport for much of the agricultural production, a situation that led to economic hardship for many shippers. The economic facts of life never change. Then as now competition was the key. If water transport was available, rail rates remained consistently low. Where the rails were the only available means of long distance transport, shippers suffered the inevitable consequences of severe rate conditions. Where more than one railroad served a given area, those rails would wage rate wars and the rates fluctuated. When only one railroad served an area, however, the shipper again suffered.

The inequities in the system, particularly long and short haul rate discriminations, rebates and service differences, brought cries for relief from both shippers and the rails themselves. The result, as you know, was the Interstate Commerce Act of 1887 which established the Interstate Commerce Commission and the beginning of the federal regulatory experiment.

It has been said that freight transportation and agriculture grew up together in the United States. Certainly they have traditionally had a symbiotic relationship that has flourished since the time agriculture was still at the subsistence level. Agricultural commodities were the primary freight of early transport and it was the norm that transportation service followed agricultural production.

The very fact that we are meeting this week to discuss the impact of transportation regulation on agriculture is evidence of our attempt to keep the symbiosis between these two industries thriving.

Another important development was the start of truck competition around World War I and the eventual passage of the Motor Carrier Act in 1935. Soon after that came regulatory legislation affecting water carriers. From this point on we can witness a phenomenon which persists and causes dissension to this day. While all traffic moved by the railroads was subject to regulation, agricultural commodities moved by motor carrier and most dry bulk commodities moved by barge were exempt.

Although the specifics of these regulations have

been altered somewhat in the following decades, the situation essentially remains. Today we have a mixed system of economic regulation for the transportation of agricultural commodities. Recent pressures to diminish regulation of the nation's transportation system is just a facet of the overall concern with Federal regulation not only in transportation but across the board.

In February of this year a significant attempt was made to cut back Federal regulation by passage of the Railroad Revitalization and Regulatory Reform Act. The thrust of the legislation is, of course, to accord the industry a measure of rate freedom. It allows the railroads to adjust their rates relatively free of regulatory interference provided they do not possess market dominance over the traffic in question.

Of course, if we are to face the issue of deregulation fairly and squarely, we must also look at the pro-regulation side. This is what makes our panel discussion this afternoon so vital. Along with the argument for less regulation, there are those who feel it would result in increased inefficiencies and thus increased transportation costs.

# Modelling Service-Differentiated Demand for Freight Transportation: Theory, Regulatory Policy Analysis, Demand Estimation[1]

by A. F. Daughety and F. S. Inaba
Assistant Professors of Managerial Economics and Transportation, and Industrial Engineering and Technology, respectively, Northwestern University

It has long been recognized that in its simplest form the demand for freight transportation is derived in part from a process in which spatially separated markets engage in trade that results in the physical movement of goods from one market to another. The equilibrium concept that has evolved to explain the behavior of the flow of trade and the goods-prices in such markets is called spatial price equilibrium. This concept can be extended to reflect the interdependence between spatially separted markets and the transport sector.

The basic theory of spatially separated markets has generally treated the transport sector as though it provides a homogeneous service that is available at a constant transport rate. Examples of this approach include Enke (6), Samuelson (14), Smith (16), Takayama-Judge (18), and Silberberg (15). This view is obviously unrealistic. Rather, the transport sector is comprised of alternative modes that offer differentiated transport services (e.g., speed of delivery, reliability, damage, etc.) at different transport rates.

A notable departure from the view that transport is a homogeneous service available at constant prices is Stucker's econometric model of transport demand (17). In this study he extends the basic spatial transport model to include several modes with differentiated service characteristics. His analysis deals mainly with the two mode case in which service differences are absorbed into the transport costs incurred by the shipper.

In section 2 of this paper we present a theory of demand for freight transportation. It incorporates service differentiation in a multi-mode, multi-market model. Included in service differentiation are modal characteristics such as supply price, speed of delivery, handling and loading costs, loss and damage, equipment availability and variation in scheduled transit times.

In this section we show that in general, it is optimal for a shipper to split modes and markets in his distribution pattern. In other words it is usually not optimal for shippers to send shipments by only one mode to one market. This implies that demand for transport, which is derived, is complex and embodies not only a modal rate but characteristics of all the modes and markets. Modal demand is derived and conditions for market equilibrium are examined.

In section 3 the model is used to analyze a regulatory policy: flexible transport rates. A dynamic model shows that differences in the quality of service provide conditions under which stability of intermodal competition may obtain in the face of increasing returns-to-scale in a monopolized mode. Thus, econometric studies concerned with such issues must include degree of service differentiation along with measures of the extent of returns-to-scale in order to actually assess market power.

Finally, section 4 examines two econometric models for estimating the demand for grain transportation that can be derived from the theory in section 2. The first model, using regression, embodies mode-market splitting. It is argued that this ap-

proach faces serious data problems and that misspecification error is highly likely. A second approach, based on qualitative choice models (i.e., logit) is examined. The approach reduces the data acquisition problem and avoids some of the misspecification issues inherent in regression analysis.

## MULTI-MODAL SPATIAL PRICE EQUILIBRIUM

### The Two-Market, One-Mode Case

Consider a single homogeneous commodity that is bought and sold in either of two spatially separated markets, $A$ and $B$. Let $S_A(p_A)$, $D_A(p_A)$, $S_B(p_B)$ and $D_B(p_B)$ be the supply and demand function for the two markets where $p_A$ is the price in market $A$ and $p_B$ is the price in market $B$. As shown in Figure 1, we assume that $\bar{p}_B > \bar{p}_A$ where $S_A(\bar{p}_A) = D_A(\bar{p}_A)$ and $S_B(\bar{P}_B) = D_B(\bar{P}_B)$, i.e., $\bar{p}_A$ and $\bar{p}_B$ are prices that clear their respective markets. Now let $Q_A(o_A) = S_A(p_A) - D_A(p_A)$ and $Q_B(p_B) = D_B(p_B) - S_B(p_B)$, i.e., $Q_A(p_A)$ is the quantity of the good exported by market $A$ at price $p_A$ while $Q_B(p_B)$ is the quantity of the good imported by market $B$ at price $p_B$. Given that the demand and supply functions in both markets are continuously differentiable, monotonic and that $S_A' > D_A'$, $S_B' > D_B'$ (i.e., Walrasian stable), then we can invert $Q_A(p_A)$ and $Q_B(p_B)$. We will label the new functions $P_A(Q_A)$ and $P_B(Q_B)$. Clearly, $P_A' > 0$, $P_B' < 0$.

Figure 1 is a standard representation of the supply and demand curves in the two markets (14). We can determine the level of exports and imports and their corresponding prices from the excess supply price and demand price curves $P_A(Q_A)$, $P_B(Q_B)$. Finally, to avoid pathological cases we assume that there exists some quantity $\tilde{Q}$ such that $P_A$ and $P_B$ intersect, i.e., $P_A(\tilde{Q}) = P_B(\tilde{Q})$.

If only one type of homogeneous transport service exists between the two markets, then the analysis is straight-forward. Let $Q = S_T(p_T)$ be the supply function for transport service, i.e., $Q$ units will be shipped from $A$ to $B$ at rate $p_T$. If $p_T = 0$ then from above we know that the demand will be for $\tilde{Q}$ to be shipped. On the other hand, if $p_T = \bar{p}_B - \bar{p}_A$, then there will be no demand for transport service. In general the demand for transport service is found by subtracting $P_A(Q)$ from $P_B(Q)$ (since $Q_A = Q = Q_B$). Figure 2 displays the resulting transport sector market equilibrium solution. In equilibrium the transport rate is $p_T^*$. Thus $Q1$ units are transported from $A$ to $B$. This means that the price in $A$ is $P_A(Q^*)$ and the price in $B$ is $P_B(Q^*)$. Therefore, we can find the quantities of goods produced and sold in all markets. Given elasticities of the supply and demand functions in the two markets one could calculate the elasticity of transport demand (7). One could also pose the supply of transport as monopolistic (12). Later in the paper we will examine a problem in partial monopoly. First, however, we will extend the

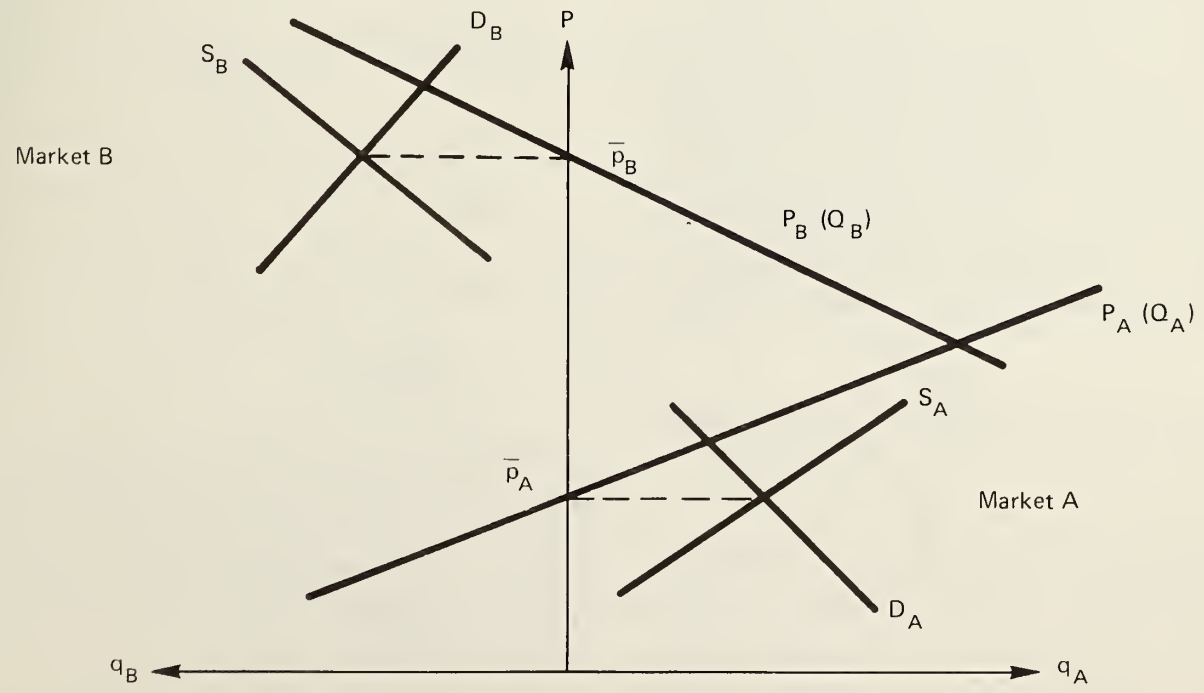



**Figure 1. Markets for the commodity**

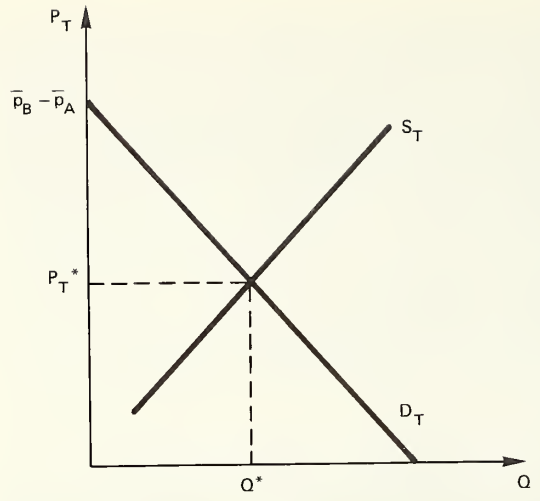



**Figure 2. Two market, one mode equilibrium**

above to multiple modes. This extension is critical since transport service is not homogeneous but is provided by many forms of technology and is differentiated in its provision. Initially we will assume that modes differ in speed of delivery and have different supply functions. Later we will add other service characteristics.

## The Two-Market, Multi-Mode Case

*The goods-producers' problem.*—Assume now that every shipper in $A$ can choose to ship goods to $B$ by $M$ different modes. We will assume that the modes are differentiated in terms of their supply price function ($p_m(q_m)$ for shipping $q_m$ from $A$ to $B$) and speed of delivery ($T_m$, $m = 1, \ldots, M$). Speed of delivery is a service characteristic; the faster the mode, the more valuable the service. In particular, since a shipment sent to $B$ is sold $T_m$ time units later than it could have been sold in $A$, we will assume that the return from $B$ is discounted when comparing it to $A$. The $n$th goods producer in $A$ takes as given the commodity prices $P_A$, $P_B$, the transport rates on each mode, $p_m$, and the interest rate $r$. His problem is to produce total output $q^n$ at a cost $C^n(q^n)$, sell $q_A^n$ in $A$ and ship $q_m^n$ to $B$ by mode $m$. Thus the optimization problem for the $n$th firm is

$$\max P_A q_A^n + \sum_{m=1}^{M} P_B e^{-rT_m} q_m^n - \sum_{m=1}^{M} p_m q_m^n - C^n(q^n)$$

$$\text{Subject to (a)} \quad q^n = q_A^n + \sum_{m=1}^{M} q_m^n$$

$$\text{(b)} \quad q_m^n \geq 0 \ .$$

It can be shown (see 3) that the firm's optimal *distribution* conditions are (the optimal production condition is $C^n(q^n) = P_A$):

$$\left.\begin{aligned} &(1) \quad P_B e^{-rT_m} q_m^n = P_A q_m^n + P_m q_m^n \\ &(2) \quad P_B e^{-rT_m} \leq P_A + P_m \\ &(3) \quad q_m^n \geq 0 \ . \end{aligned}\right\} m = 1, \ldots, M$$

Condition (1) states that a profit maximizing goods producer uses the $m$th mode up to the point at which the discounted revenue from $B$ just equals the opportunity costs of not selling in $A$ ($P_A q_m^n$) plus transport costs $p_m q_m^n$. Condition (2) is a marginal condition such that any incremental quantity shipped on mode $m$ yields opportunity costs plus transport costs ($P_A + p_m$) at least as great as discounted returns, $P_B e^{-rT_m}$. If (2) does not hold then profits can always be increased by shipping an additional unit by the $m$th mode.

*Market equilibrium conditions and the demand for transport service.*—In this section we show that conditions analogous to (1)–(3) can be used to define an equilibrium for the whole economy. Let $q_m$ be the amount carried by mode $m$. Clearly the total flow $Q(=Q_A = Q_B)$ is simply $\Sigma_m q_m$. We will say that $q_1, \ldots, q_M$ are equilibrium flows if they satisfy the following conditions:

$$(4) \quad \sum_{m=1}^{M} P_B(Q) e^{-rT_m} q_m = P_A(Q) Q + \sum_{m=1}^{M} p_m(q_m) q_m$$

$$(5) \quad P_B(Q) e^{-rT_m} \leq P_A(Q) + p_m(q_m)$$

$$(6) \quad q_m \geq 0 \ .$$

Assuming that $p_m(q_m)$ arises from profit maximization in the transport firm and that it is monotonically increasing and continuous, then it can be shown (see 3) that (4)–(6) has a unique solution. When this solution is found, it sets prices so that each goods producer can maximize profits. Thus all possible gains are arbitraged.

Let $Q$ be *any* total flow between $A$ and $B$ and let

$$R_m(Q) = P_B(Q) e^{-rT_m} - P_A(Q) \ .$$

$R_m(Q)$ is the unit differential return associated with a unit sold in $B$ versus $A$. We can now derive the demand for transportation by mode $m$. Under perfect competition (in the goods market) $R_m(Q)$ would be the goods producer's demand price ($p_m^D$) for mode $m$ transport. In response to this offer, the $h$th transport firm offering mode $m$ service carries $q_m^{h*}$ units which is the solution to

$$\max p_m^D q_m^h - C_m^h(q_m^h)$$

with $C_m^h(\cdot)$ a standard (increasing marginal cost) cost function. Thus *total* modal supply is

$$q_m^S = \sum_h q_m^{h*},$$

i.e., it is the sum of optimal quantities supplied by all firms offering mode $m$ service. Thus, the quantity demanded of any mode $i$ is simply the difference between the total flow $Q$ and the total that would be shipped at the respective demand price ($p_m^D$) by all modes other than $i$, i.e.;

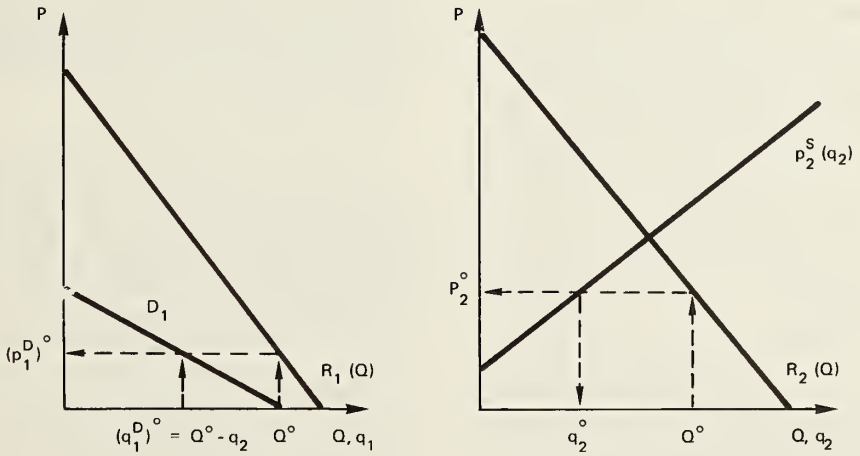
$$q_i^D \equiv \max\left\{0, Q - \sum_{\substack{m \neq i \\ m=1}}^{M} q_m^S\right\}.$$

Figure 3 depicts the method of finding price-quantity pairs $(p_i^D, q_i^D)$. We will call the set of price-quantity pairs $(p_i^D, q_i^D)$ that have been defined above the *residual demand curve for mode i*. It should be emphasized that this demand relationship was not derived in the standard fashion in that *prices on the modes were allowed to vary* (as $Q$ varied). The approach is valid since the choice of mode by a goods-producer is assumed to depend only on a profit criterion, i.e., the mode that is best (including speed of delivery considerations) is the one that is used. In (3) it is shown that the resulting residual demand curves are downward sloping as one would expect. Figure 4 depicts the demand and supply functions for a two-mode model. The starred quantities and prices are the equilibrium solution.

*Two-Market, multi-mode case summary.*—Before proceeding to the multi-market case and the inclusions of other service characteristics, it is best to pause and summarize the last few sections. The development of a multi-mode model required the inclusion of service characteristics. We have used speed of delivery as a surrogate and have incorporated it in a simple and direct manner. The result is that demand curves are significantly more complex. They embody not only the characteristics of the mode in question, but of the other modes. This is a crucial point. Transport can not be approached in the same way we estimate commodity demand. Estimation procedures must account for alternative mode characteristics and prices as well as commodity characteristics.

## The Multi-Market, Multi-Mode Case with Firm-Level Modal Splitting

*The goods-producers' problem.*—In this section we will expand the model to allow for multiple mar-




To obtain mode one demand curve solve

$(R_1(Q), R_2(Q), p_2^S(q_2)$ given):

$p_1^D(q_1) = R_1(q_1 + q_2)$

$p_1^S(q_2) = R_2(q_1 + q_2)$

To obtain mode two demand curve (not shown) solve

$(R_1(Q), R_2(Q), p_1^S(q_1)$ given):

$p_1^S(q_1) = R_1(q_1 + q_2)$

$p_2^D(q_2) = R_2(q_1 + q_2)$

**Figure 3. Deriving mode one's demand curve**

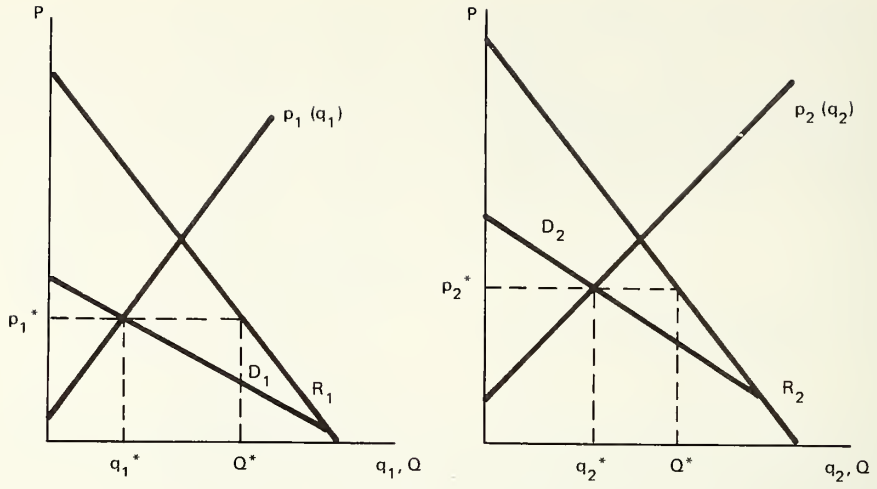



**Figure 4. Market equilibrium using residual demand curves**

kets, other service characteristics such as physical reliability (e.g., loss and damage), schedule reliability (e.g., late arrival), and special costs such as loading and handling costs. The overall result is that an individual firm will in general find modal and market splitting optimal. Thus, in general it will be optimal to send shipments to different markets and by different modes rather than ship all output to one market by one mode. This result is in contrast to the standard, traditional assumption that in perfect competition the individual goods-producing firm will choose one market and one mode to use.

Formulation of the goods producers' problem requires us to expand the notation from before. Let $P_j$ be the price for the good in market $j$ ($j = 1, \ldots, J$) with $i$ representing the home market. Let $q_{ijm}$ be the amount sent from $i$ to $j$ by firm $n$ at $i$ by mode $m$ which services the $(i, j)$ pair. Let $T_{ijm}$ be the time it takes to go by mode $m$ from $i$ to $j$, ($T_{iim} = 0$). In a slight change of notation, let $t_{ijm}$ be the transport rate charged for sending a unit of the good from $i$ to $j$ by mode $m$, ($t_{iim} = 0$). The reason for this change will become apparent later. Let $q_i^n$ be the total amount of good produced by firm $n$ at location $i$; we assume that the associated cost function $C_i^n(\cdot)$ has the standard neoclassical properties.

If we were to formulate the goods producers' problem at this point, it would be exactly like the earlier formulation save for some extra subscripts. We are in a position, however, to consider more service characteristics than simply the speed of delivery. Specifically we will incorporate costs of loading and handling and costs associated with schedule and physical reliability.

In the case of loading and handling we take such costs to be represented by a function of the amount shipped, i.e., $q_{ijm}^n$. The function notation will be $H_{ijm}^{nL}(\cdot)$. We assume that such a function is strictly convex with only positive derivatives, i.e., $(H_{ijm}^{nL})' > 0$, $(H_{ijm}^{nL})'' > 0$. This function gives the cost associated with taking a finished product and loading it on a specified mode to go to a specified market. The strict convexity reflects the fact that as more is loaded we typically observe congestion costs being imposed. We *emphasize* that *strict* convexity is not required for what follows.

In the case of physical and schedule reliability a more detailed mathematical treatment is warranted. By physical reliability we are referring to loss and damage. By schedule reliability we mean the effect of equipment availability and transit time variance on the ability of a goods-producer to deliver a shipment to a receiver on a promosed date. Both types of reliability introduce the notion of risk into the decision as to where to ship and by what mode. One could, in fact, view the selection of market and mode as a portfolio problem of investment in risky assets. Extending the analogy we see that modal and market splitting is then to be *expected*, since *diversification* will help ameliorate the risk.

To account for risk we will describe a function $H_{ijm}^R(\cdot)$ of the amount sent from $i$ to $j$ by firm $n$ on mode $m$. $H_{ijm}^R(\cdot)$ is the *risk* function and reflects the cost of an insurance policy, purchased in a perfectly competitive insurance market, that pays all penalties for late arrivals and reimburses a recipient for loss and damage sustained by the goods. In agricultural terms loss and damage is sometimes referred to as shrink, i.e. a certain fraction of a corn shipment is lost due to dehydration, etc. In general, the insurance policy reflects the cost associated with transporting the commodity between two locations by some mode. Clearly such a cost is a function of the $(i, j)$ pair and the mode.

We shall now show that $H_{ijm}^R(\cdot)$ is strictly convex with positive first derivative. We will first introduce some notation which reflects the mode-market attributes and then supress the subscripts in our proof of the properties of $H_{ijm}^R(\cdot)$. Let $\theta_{ijm}$ be a random variable reflecting the percentage loss and damage incurred by shipping a unit of good from $i$ to $j$ by mode $m$. For simplicity of exposition we assume that it takes

on two possible values:

$$\theta_{ijm} = \begin{cases} \bar{\theta}_{ijm} \text{ with probability } 1 - d_{ijm} \\ \qquad (0 \leqslant \bar{\theta}_{ijm} \leqslant 1) \\ 0 \text{ with probability } d_{ijm} \ . \end{cases}$$

Thus if $y^n_{ijm}$ is the amount of goods received at $j$ that were sent by firm $n$ at location $i$ by mode $m$, then

$$y^n_{ijm} = (1 - \bar{\theta}_{ijm}) q^n_{ijm} \ .$$

Furthermore let $K_j$ be the per unit penalty cost for lateness of arrival. Such lateness of arrival can come about from failure of modal equipment (railroad cars, barges, etc.) to be available when promised or from variance in scheduled modal transit times. We assume simply that a shipment is either on time (with probability $f_{ijm}$), or late (with probability $1-f_{ijm}$), in which case the per unit penalty $K$ must be paid. Thus while the premium, $H^R_{ijm}(q^n_{ijm})$ for shipping $q^n_{ijm}$, is paid with certainty, there are two types of losses that the insurance company might incur. The first is that it might have to cover the market value of the loss and damage, namely, $P_j(q^n_{ijm} - y^n_{ijm})$. The second potential loss is the penalty cost, $K_j q^n_{ijm}$.

Insurance companies (one of which might represent the goods-producer himself as a self-insurer) are assumed to be risk-averse. In other words, we assume that they can be represented by a neo-classical utility function whch is increasing and concave as a function of money. Let $U(\cdot)$ be such a function. Thus $U'(\cdot) > 0$, $U''(\cdot) < 0$. Thus the insurance company is risk-averse. We assume that the insurance company maximizes expected utility, i.e., it solves:

$$\max E\{U(H(q) - P(q-y) - Kq)\}$$

where subscripts have been dropped to facilitate the analysis. If the insurance market is perfect, then the company will be indifferent between the maximum expected utility above and the utility of no transaction $U(0)$. Thus, we have that in equilibrium:

$$\begin{aligned} (7)\ U(0) = {} & f \cdot d \cdot U(H(q)) + f(1-d) \cdot U(H(q) - P(q-y)) \\ & + (1-f) \cdot dU(H(q) - Kq) \\ & + (1-f)(1-d)U(H(q) - P(q-y) - Kq) \ . \end{aligned}$$

If we now totally differentiate (7) and solve for $H'(q)$ we find that it is positive:

$$H'(q) = \frac{\begin{array}{c} P\bar{\theta}f(1-d)U_2' + (1-f)dU_3' \cdot K \\ + (1-f)(1-d)U_4' \cdot (P\partial + K) \end{array}}{fdU_1' + f(1-d)U_2' + (1-f)dU_3' + (1-f)(1-d)U_4'} > 0$$

where, to simplify the notation, we have used:

$$\begin{aligned} U_1 &= U(H(q)) \\ U_2 &= U(H(q) - P(q-y)) = U(H(q) - P\bar{\theta}q) \\ U_3 &= U(H(q) - Kq) \\ U_4 &= U(H(q) - P(q-y) - Kq) = U(H(q) - P\bar{\theta}q - Kq). \end{aligned}$$

Thus, as the shipment size increases, the premium increases. Totally differentiating (7) a second time yields the result that $H''(q)$ is also *positive*. Thus, in general, $H^R_{ijm}(\cdot)$ is *strictly convex* in $q^n_{ijm}$.

We are now finally in a position to formulate the goods-producers' problem. For firm $n$ in location $i$ choosing among modes and markets, the producer will find $(q_i^n, q^n_{ijm})$ that solves (given $P_j$, $r$, $T_{ijm}$ and $t_{ijm}$):

$$(8)\quad \max P_i q^n_{ii} + \sum_{j \neq i} \sum_m [(P_j e^{-rT_{ijm}} - t_{ijm}) q^n_{ijm} - H^n_{ijm}(q^n_{ijm})] - C^n_i(q^n_i)$$

$$\text{Subject to } (9)\quad q^n_i = \sum_{j \neq i} \sum_m q^n_{ijm} + q^n_{ii} \geqslant 0$$

$$(10)\quad q^n_{ijm} \geqslant 0 \quad \underset{j \neq i}{j=1,\ldots,J} \quad m=1,\ldots,M$$

where $H^n_{ijm}(q^n_{ijm}) \equiv H^{nL}_{ijm}(q^n_{ijm}) + H^R_{ijm}(q^n_{ijm})$.

Note that production for the home market $q^n_{ii}$ is unconstrained. Under some conditions the producers will choose to sell in the home market while in others they might choose to *buy* (and ship). The Kuhn-Tucker conditions are (after substituting (9) into (8))

$$q^n_i(P_i - C^{n'}_i(q^n_i)) = 0$$

$$q^n_{ijm}((P_j e^{-rT_{ijm}} - t_{ijm} - H^{n'}_{ijm}(q^n_{ijm}) - P_i) = 0 \quad \forall j, m$$

$$q^n_i - \left(q^n_{ii} + \sum_{j \neq i} \sum_m q^n_{ijm}\right) = 0$$

$$q^n_{ijm} \geqslant 0 \quad \forall j, m \qquad q^n_i \geqslant 0$$

$$P_j e^{-rT_{ijm}} - t_{ijm} - H^{n'}_{ijm}(q^n_{ijm}) - P_i \leqslant 0 \ .$$

Thus, for positive $q^n_{ijm}$ we have

$$(11)\quad P_j e^{-rT_{ijm}} - t_{ijm} - H^{n'}_{ijm}(q^n_{ijm}) = P_i = C^{n'}_i(q^n_i)$$

$$\forall j, m$$

$$(12)\quad q_{ii}^n = q_i^n - \sum_{j \neq i} \sum_m q_{ijm}^n .$$

The firm can be thought of as being involved in the following sequence of activities. First, it decides a production level by solving $P_i = C_i^{n\prime}(q_i^n)$. Then it equates marginal revenues and costs among the various mode-market pairs. Finally it decides how much to sell or buy in the home market so as to complete its plans. Notice that the left side of (11) is downward sloping due to the nature of $H_{ijm}^R$. A graphical solution is shown in Figure 5. As long as the mode-market marginal curve intersects the price axis above $P_i$, then flow is positive. If any marginal intersects the axis below $P_i$, then the associated flow variable will be zero and its associated Kuhn-Tucker multiplier will be positive. Clearly, unless one mode-market pair completely dominates all others, mode-market splitting will occur.

*Market equilibrium conditions.*—It is now quite simple to write down the market equilibrium conditions. All conditions are written on the assumption that we have a given home location, namely, market $i$. Then $q_i = (q_{i11}, \ldots, q_{iJM})$ is an equilibrium vector of flows if it satisfies $(\forall j,\ \forall m)$

$$q_{ijm}\left[P_j(Q_j)e^{-rT_{ijm}} - t_{ijm}(q_{ijm}) - H'_{ijm}(q_{ijm}) - P_i(Q_i)\right] = 0$$

$$P_j(Q_j)e^{-rT_{ijm}} - P_i(Q_i) \leqslant t_{ijm}(q_{ijm}) + H'_{ijm}(q_{ijm})$$

$$q_{ijm} \geqslant 0 .$$

We have assumed that one can aggregate (by summing inverses) $H_{ijm}^n(q_{ijm}^n)$ over firms to produce $H_{ijm}(q_{ijm})$. It should be noted that $H_{ijm}^R(\cdot)$ is already at an aggregate level, and it only remains to aggregate $H_{ijm}^{nL}(\cdot)$ over all firms. We note also that the above conditions are of the same form as the previous model if we set $p_{ijm}(q_{ijm}) = t_{ijm}(q_{ijm}) + H'_{ijm}(q_{ijm})$, i.e., we associate the direct transport costs ($t_{ijm}$) with the indirect imposed costs, for convenience of exposition. Finally, the demand curve for using mode $m$ service to ship goods from $i$ to $j$ is found by solving:

$$P_{ijm}^D(q_{ijm}) = R_{ijm}(Q_i, Q_j)$$

$$P_{i\ell k}^S(q_{i\ell k}) = R_{i\ell k}(Q_i, Q_\ell) \qquad \forall_\ell \forall_k \text{ such that } (\ell, k) \neq (j, m)$$

where

$$R_{ijm}(Q_i, Q_j) = P_j(Q_j)e^{-rT_{ijm}} - P_i(Q_i)$$

$$P_{ijm}^S(q_{ijm}) \equiv P_{ijm}(q_{ijm})$$

$$Q_i = \sum_n (q_i^n - q_{ii}^n)$$

$$Q_j = \sum_{i,m} q_{ijm}$$

## AN APPLICATION TO A POLICY QUESTION

In this section we will examine a proposal for regulatory change using the analytical structure developed in the previous section. We will assume that two modes exist to transport goods between two

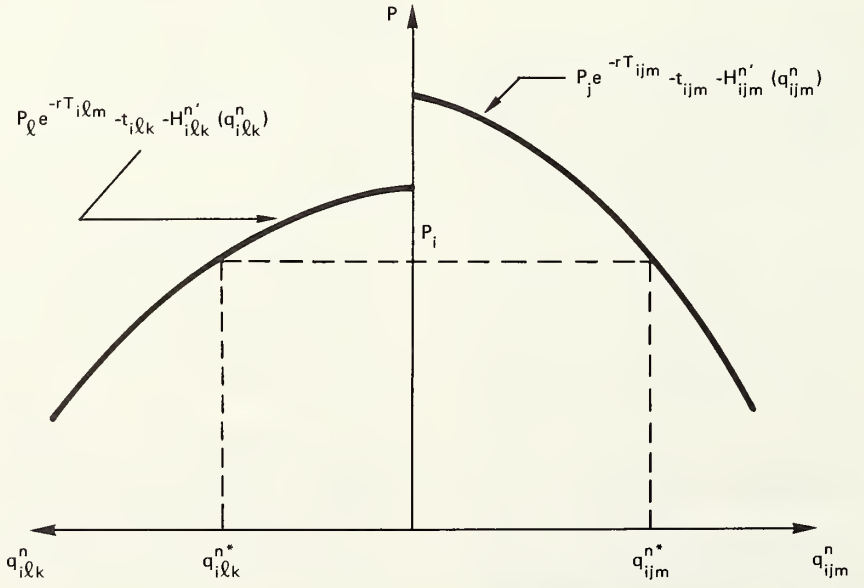



**Figure 5. Individual modal splitting in a multi-market, multi-mode framework**

spatially separated markets that trade in one commodity. One of these modes will represent a single-firm industry (e.g., a railroad) while the other will consist of perfectly competitive firms (e.g., owner-operator truckers). For simplicity, we will assume that the service differentiation is sufficiently summarized by speed of delivery.

Our basic policy question is whether long run intermodal allocation of freight can be maintained when all modal prices are flexible. While we do not provide a simple answer to this question, our analysis does provide some insights. Specifically, differences in the quality of service provide conditions under which stability of intermodal competition may obtain in the face of increasing returns-to-scale in the monopolized mode.

## Short and Long Run Equilibrium

As stated above, the first mode is represented by a single firm while the second mode consists of a large number of small competitive firms. Let $x$ be the number of mode two firms. In the aggregate they haul $q_2$. Thus we can write the system of equations describing the demand for mode 1 service as

$$P_1^D(q_1) = R_1(q_1 + q_2)$$

$$P_2^S(q_2, x) = R_2(q_1 + q_2)$$

We assume that

$$P_{2,q}^S \equiv \frac{\partial P_2^S}{\partial q_2} > 0$$

$$P_{2,x}^S \equiv \frac{\partial P_2^S}{\partial x} < 0 .$$

Thus, additional firms entering the market to provide mode two service shift the supply curve to the right, lowering supply price. In the short run the number of competitive firms is fixed. Thus, a short run equilibrium is conditioned on the number of mode two firms. Formally, the short run equilibrium $E(x)$ is the equilibrium set of transport prices and quantities

$$E(x) = \{p_1^*(x), q_1^*(x), p_2^*(x), q_2^*(x)\}$$

where $E(x)$ satisfies:

$$(13) \quad P_1^D(q_1^*(x)) = R_1(q_1^*(x) + q_2^*(x))$$

$$(14) \quad P_2^S(q_2^*(x), x) = R_2(q_1^*(x) + q_2^*(x))$$

$$(15) \quad MR_1(q_1^*(x)) = MC_1(q_1^*(x))$$

where $p_1^*(x) = p_1^D(q_1^*(x))$ and $p_2^*(x) = p_2^S(q_2^*(x), x)$. This equilibrium is illustrated in Figure 6. Equations (13) and (14) are the demand curve (mode 1) equations while (15) is the first order condition for mode one profit maximization. In other words, in the short run the market is in equilibrium when the dominant firm (mode one) is setting price optimally such that the market for the competitive mode is cleared and such that the goods markets are cleared. Equations (13)–(15) embody this.

Note, however, that the short run equilibrium price in mode two ($P_2^*$) may not equal the minimum long run average cost ($c^*$). Here we will assume that this minimum is the same for all firms offering mode two service. If $p_2^* \neq c^*$ then there is an incentive for entry or exit, which means that the number of firms will change. Let $x_t$ denote the number of competitive firms in period $t$. We will describe a simple entry-exit process such that, if $p_2^* > c^*$, firms enter and if $p_2^* < c^*$, firms leave. It is:

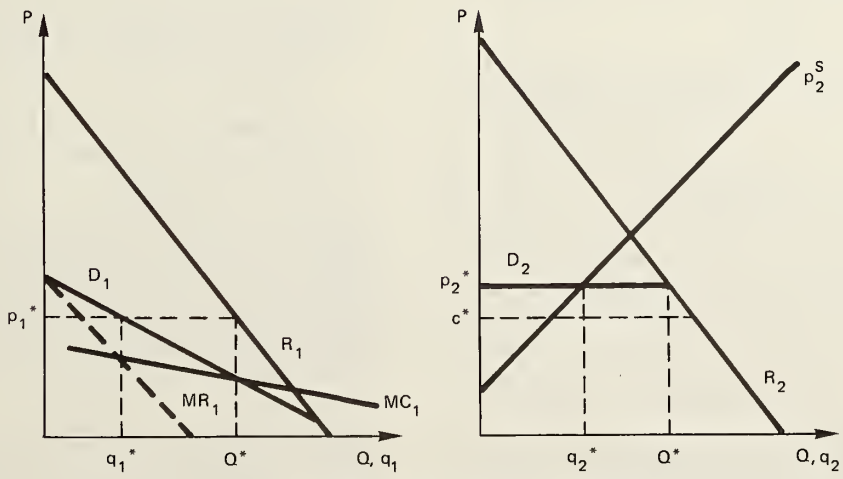



**Figure 6. Short run unregulated equilibrium**

(16) $x_{t+1} = f(x_t) \equiv x_t + h(p_2^*(x_t) - c^*)$

where $h(0) = 0$ and $h^* > 0$.

Thus, if we start with $x_0$ firms, then the short run equilibrium is $E(x_0)$ with prices $p_1^*(x_0)$, $p_2^*(x_0)$. The number of firms in mode 2 now adjusts (if $p_2^*(x_0) \neq c^*$) and we get $x_1 = f(x_0)$ firms. This determines a new short run equilibrium $E(x_1)$, and so on. A sequence of short run equilibria $\{E(x_t)\}_{t=0,1,\ldots}$ is generated. The natural question concerns whether (and when) this sequence settles down to a long run equilibrium. A long run equilibrium is attained when there is some number of firms $x^*$ that doesn't change from period to period (no net entry or exit). Thus, we are interested in when $x^* = f(x^*)$. This occurs only when $p_2^*(x^*) = c^*$. Since in general we can assume that there is a value of $c^*$ such that for some value of $x^*$ the equality is true, then we can generally assume that there is at least one long run equilibrium in which both modes are represented.

## Stability of Intermodal Splitting

In this section we will explore a (sufficient) condition for stability. This condition is derived in (4). It can be shown that a sufficient condition for stability is $|f'(x^*)| < 1$ (see 13). This implies that a sufficient condition for stability is

$$(17) \quad -\frac{2}{h'(0)p_{2,x}^S} \cdot \frac{(p_{2,q}^S - R_2')}{R_2'} < \frac{P_1^{D'}}{MR_1' - MC_1'} - 1 < 0$$

In general, if $h'(0)p_{2,x}^S$ is small, then we would expect the left hand inequality to be satisfied. $h'(0)$ is small if entry and exit takes time and is not instantaneous. If small changes in the number of mode two firms does not cause radical shifts in supply, then $|p_{2,x}^S|$ will be small. Thus, one would expect the left hand inequality to be met.

The right hand inequality holds if and only if $MR_1' - MC_1' - p_1^{D'} < 0$. This is because second order conditions for firm one profit maximization require $MR_1' - MC_1' < 0$. This condition is, unfortunately, far from straight-forward. In order to examine it for policy conclusions, we will assume that the demand function is linear. This is not quite as restrictive as it might first appear because linearity provides the starkest of cases. Highly non-linear functions, in fact, tend to increase the number of stable solutions rather than reduce them. Further, linearity of demand is often used in econometric studies, and our results will provide a caution concerning the results of those studies.

If $p_1^D$ is linear then $MR_1' = 2p_1^{D'}$, and the condition reduces to $p_1^{D'} - MC_1' < 0$. Clearly, when marginal costs are increasing, this condition is always met, i.e., stable intermodal competition obtains. Traditional theory, however, indicates that when marginal costs are decreasing, one should not expect stability. The reason that this is not necessarily correct is that it ignores service differentiation. It can be shown (see 4) that, even with decreasing marginal costs, service differentiation acts as a countering force to what would otherwise be a destabilizing influence.

To be slightly more specific, it can be shown that, if marginal costs are only somewhat declining, then in fact the competitive mode must *not* provide service that is significantly superior to the monopolized mode if stability is to be maintained. As marginal costs decline more rapidly, the maximal separation in service is reduced until, with rapidly declining marginal costs, stability is only consistent with significantly superior service on the monopolized mode.

## Policy and Research Implications

What does all this mean with respect to transport policy and research? A couple of implications are the following:

1) Increasing returns-to-scale, in and of themselves, do not necessarily mean that the only way to provide for stable multi-modal service is to regulate the monopolized mode's price. Service differentiation can act as a strong brake on market power. In fact, if the monopolized rate is set so that the competitive rate is above long run average cost for the competitive mode, competitive mode entry will be encouraged. As long as this situation continues, the residual demand for the monopolized mode will fall, eroding its market share (see 4). Thus, regulation of the rate may, in fact, lead to *eliminating* an alternative mode (in this case, the regulatee) from the shippers' choice set.

2) Econometric studies of returns-to-scale are not typically sufficient to determine whether real market power exists. Studies must be extended to examine the relationships between service parameters. The *extent* of returns-to-scale and the *degree* of service differentiation must be estimated together.

A caution is in order. There is nothing in the above analysis that addresses the welfare implications of the long run stable intermodal relationship. In the long run, price will equal marginal cost in the competitive mode but price may be above marginal cost in the monopolized mode. The question of which course to follow, i.e., whether or not to control rates, revolves around the potential welfare losses arising from the inequality of price and marginal cost versus the cost of achieving and administering their equality.

## ESTIMATION OF DEMAND FOR TRANSPORTATION OF GRAIN

In this section we shall propose a model of grain elevator shipping decisions and discuss alternative ways to estimate the model. The major premise of this work is that the demand for transportation is derived from the needs of the firm to sell its product in spatially separated markets. The focal point is the individual elevator, and hence the model is disaggregate.

We find that the model allows for two types of estimation methods; regression and choice models. The regression approach, while conceptually preferable to the choice model approach, is impractical because of data requirements and certain theoretical problems concerning costs. Thus use of choice models in estimating transport demand seems more practical in the light of data requirements. Choice models have been justified on theoretical grounds and are shown to be applicable in our model in certain circumstances.

### The Model of a Grain Elevator's Shipping Decisions

The production process for a grain elevator consists of two basic functions. The first function is to purchase grain from various suppliers such as farmers and other elevators and make it available for sale and distribution. This function involves such activities as the procurement of grain on the local market, processing, handling, storing and hedging. It is assumed that a total cost can be associated with each level of saleable product.

The second function is the sale and distribution of total output to distant markets and/or to the local market (which includes storing the grain). Two types of costs must be reckoned with in this shipping function. The first consists of the direct transport charges that are levied by the carriers. The second type of costs are only indirectly attributable to transportation. These indirect costs are discussed below.

*Equipment delay costs.*—A shipment must be placed in a holding position ready for loading onto the transport equipment at some planned equipment arrival date. If there is uncertainty as to when the equipment will be supplied, this date is typically earlier than the actual arrival date. Thus, there is an expected equipment delay time which is assumed to vary by mode. Grain that is kept in a holding position incurs a warehouse carrying cost over the length of the delay time.

*Transport loading and unloading costs.*—It will be assumed for simplicity that common costs in loading and unloading can be allocated.

*Moving inventory interest costs.*—During transit an interest cost is incurred on the value of the shipment. The interest cost per unit of shipment varies by mode and destination because transit times vary.

*Risk related transit costs.*—Grain in transit is subject to loss, damage and spoilage. Thus, insurance costs are incurred on each shipment. Furthermore, variance in scheduled transit time increases the risk of incurring penalties due to late arrival of goods and future loss of customers.

For a typical firm at location $i$ (we suppress the superscript $n$ from before for clarity), let:

$H^L_{ijm}$: per unit loading and unloading costs from $i$ to $j$ by mode $m$.

$d_m$: expected equipment delay time for mode $m$.

$s_i$: warehouse carrying cost (¢/bushel).

$rT_{ijm}P_j$: per bushel moving inventory interest cost from $i$ to $j$ by mode $m$.

$s_i d_m$: per bushel equipment delay cost.

The general model of the elevator's decision problem is to find total output $q_i$ and shipments $q_{ijm}$ for the planning period such that profits are maximized:

$$(18)\quad \max \sum_{j\neq i}\sum_{m} \{(P_j - rT_{ijm}P_j - t_{ijm} - H^L_{ijm} - s_i d_m)q_{ijm} - H^R_{ijm}(q_{ijm})\} + P_i q_{ii} - C(q_i)$$

$$\text{subject to:}\quad q_i - q_{i++} \geq 0,\ q_i \geq 0,\ q_{ijm} \geq 0.$$

Here $q_{i++} \equiv \Sigma_j \Sigma_m q_{ijm}$ and $q_{ii} = q_i - q_{i++}$, the amount distributed locally.

Assuming $q_i > 0$ (the non-trivial case), it can be shown that the necessary conditions for profit maximization are as follows:

$$P_i - C' + \lambda = 0$$

$$P_j - rT_{ijm}P_j - t_{ijm} - H^L_{ijm} - s_i d_m - H^{R'}_{ijm} \leq P_i + \lambda$$

$$(19)\quad \text{with equality when } q_{ijm} > 0$$

$$q_i - q_{i++} \geq 0 \text{ and } \lambda(q_i - q_{i++}) = 0$$

$$q_{ijm} \geq 0.$$

Here $\lambda \geq 0$ is the Lagrangian multiplier for the constraint $q_i - q_{i++} \geq 0$. Therefore, it is the value of an additional unit distributed to the local market.

By solving (19) for $q_{ijm}$ in terms of the $P_i$, $P_j$'s, $t_{ijm}$'s, $H^L_{ijm}$'s, $T_{ijm}$'s, $s_i$, $d_m$'s and $r$ yields the optimal shipments

$$q^*_{ijm} = \eta_{ijm}(P_i, P, t, H^L, T, s_i, d, r), \tag{20}$$

optimal output of saleable grain

$$q^*_i = \eta_i(P_i, P, t, H^L, T, s_i, d, r), \tag{21}$$

and optimal allocation to the local market

$$q^*_{ii} = q^*_i - q^*_{i++} = \eta_{ii}(P_i, P, t, H^L, T, s_i, d, r), \tag{22}$$

where symbols without subscripts represent vectors of the associated subscripted parameters.

The optimal solution is illustrated in Figure 7 for the three market, two mode case. Here we let

$$V_{ijm} = P_j - rT_{ijm}P_j - t_{ijm} - H^L_{ijm} - s_i d_m.$$

In the example shown, a positive quantity is shipped to every mode-market pair. However, since

$$q^*_{ii} = q^*_i - q^*_{i11} - q^*_{i12} - q^*_{i21} - q^*_{i22} > 0$$

then the shadow price, $\lambda = 0$. Notice that, if the local price $P_i$ were too low relative to the net prices in the distant markets, i.e., if the solution $q^\circ_i$, $q^\circ_{ijm}$ to the conditions

$$P_i - C' = 0$$

$$V_{ijm} - H^{R'}_{ijm} - C' \leqslant 0, q^\circ_{ijm}(V_{ijm} - H^{R'}_{ijm} - C') = 0$$

$$q^\circ_{ijm} \geqslant 0,$$

satisfied $q^\circ_i - q^\circ_{i++} < 0$, then the shadow price $\lambda$ of the last unit of grain allocated to the local market would be positive.

## Econometric Methods

*Regression Models.*—It has been shown that the solution of the elevator's profit maximization problem (18) yields optimal shipments

$$q^*_{ijm} = \eta_{ijm}(P_i, P, t, H^L, T, s_i, d, r). \tag{23}$$

These are the elevator's transport demand functions for the shipments of grain from location $i$ to market $j$ by mode $m$. Analysis of the theoretical model indicates that these demand functions can in principal be derived if the functions $H^R_{ijm}$ and $C$ are known.

As discussed in the previous section, $H^R_{ijm}$ are the supply curves of perfectly competitive insurance industries. Thus, using a regression approach implies that $I \cdot J \cdot M$ supply curves would have to be estimated. Since the $H^R_{ijm}$'s are expected to be convex, the form of the supply curves might be specified as quadratic.

On the other hand very little is known about the form of the cost function for the nonshipping aspects of an elevator's production process. Consequently, specification errors are potential problems in a cost study of grain elevators. Furthermore, since an elevator typically provides many other services besides selling grain, there are sure to be problems in appropriately measuring output. Finally, since there are no standard procedures for keeping and collecting cost records, obtaining data for a representative sample of elevators will be extremely difficult and expensive.

An alternative regression method of obtaining shippers' transport demand functions is to try to estimate the function (23) directly. However, a functional form must be specified. This form will depend

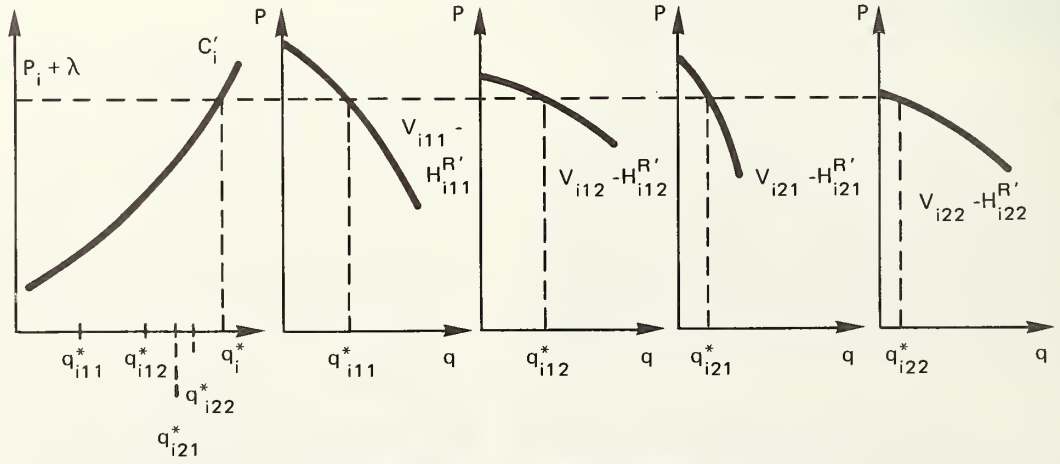



**Figure 7. Optimal distribution pattern**

on the form of the cost function $C(q_i)$ and the $H^R_{ijm}(q_{ijm})$ functions. Thus, this approach will encounter many of the same difficulties as the first approach.

The key elements in regression based models for estimating transport demand functions are the shipper's production-related and shipment-related cost functions. These models will be severely limited because cost studies are difficult to conduct. The major obstacles appear to be a paucity of accurate cost data and incomplete knowledge about the grain elevators' production process.

*Choice Models*.—A basic premise of choice models as applied to the demand for transportation of grain elevators is that in a typical planning period (covering the purchase of raw grain to the sale of the finished product) grain is either shipped to one market by one mode *or* is allocated locally. This initially appears to invalidate the use of such models since the optimal shipping pattern calls for splitting. However, since in the case of grain we are considering low value goods and low-to-medium size shipments (expecially in relation to the total stock of grain), then under these conditions one would expect significantly less splitting then under conditions wherein the value of the good was high or volumes were large. Thus, we assume that the importance of splitting to ameliorate risk rises with the value of the good and the volume of transaction.

This premise can be incorporated into the general model (18) of the grain elevator's decision problem by assuming that the functions $H^R_{ijm}(q_{ijm})$ are linear. In this case, $H^R_{ijm}$ can be absorbed into the coefficient terms for the $q_{ijm}$'s in (19). Then the optimality conditions can be written

$$P_i + \lambda - C' = 0$$

$$V_{ijm} - P_i - \lambda \leqslant 0; \quad \text{with equality when } q_{ijm} > 0$$

$$q_i - q_{i++} \geqslant 0, \lambda(q_i - q_{i++}) = 0$$

$$q_{ijm} \geqslant 0, q_i > 0.$$

These conditions imply that the elevator chooses the alternative with highest price $V_i^*$ from among the $V_{ijm}$ and $P_i$. The amount available for distribution is then determined by $C'(q_i^*) = V_i^*$, and the whole amount $q_i^*$ is distributed to the alternative corresponding to $V_i^*$. The shadow price of grain locally distributed is then determined by

$$\lambda = V_i^* - P_i.$$

The solution is illustrated for the three market, two-mode problem in Figure 8.

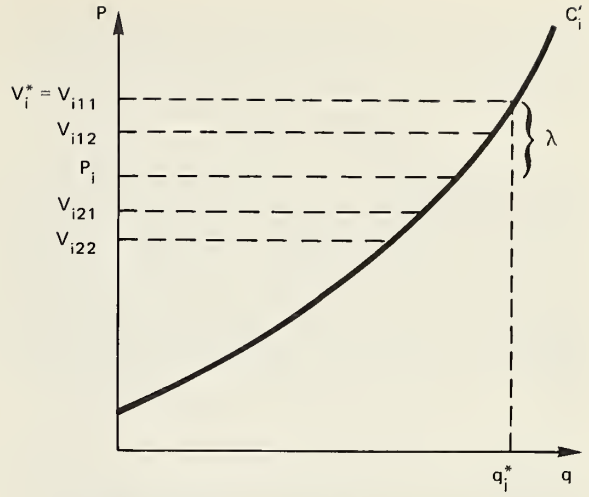



**Figure 8. Decision based on the choice model**

Thus, when the indirect transport costs $H^R_{ijm}(q_{ijm})$ are linear in $q_{ijm}$, the decision problem of the elevator is sequential. First, an alternative is chosen which yields the highest net price. The alternatives are the market-mode pairs and the local market. Then the quantity to be allocated to the chosen alternative is determined in accordance with marginal cost pricing.

As in the regression models, the second step of the choice model requires information about the elevator's cost function, $C(q_i)$. However, in empirical applications of the choice model, surrogates can be used in place of marginal cost pricing. For example, if one is willing to assume that elevators approximately price at marginal cost, then historical patterns of market-mode shares can be used to allocate sales to the alternative with the best price. The flexibility to substitute marginal cost pricing with surrogates is an important advantage of the choice models over the regression model.

Logit models are presently used in modelling urban travel demand choice behavior (5, 9, and 10). We shall give a brief description of this class of models and relate how they can be applied to the market-mode decisions of grain elevators.

Define the choice variable $y$ that takes the value $y = \eta$ if the individual chooses the $\eta$th alternative, $\eta \in N$. Let $x_\eta$ be a vector of observable attributes of the $\eta$th alternative. Let $z$ be a vector of observable characteristics of the individual, and let $w$ be a vector of unobservable variables. We assume that the individual's decision depends on the $x_\eta$'s, $z$ and $w$. Thus the probability distribution of $y$ is determined by the vector $X = (x_\eta)_{\eta \in N}, z$ and the unknown parameters that characterize the distribution of the unobservable $w$. The most general choice model (see 1) can be mathematically represented as

$$\text{Prob}\ \{y = \eta\} = \frac{\exp F_\eta(X, z, w)}{\sum_{\eta \in N} \exp F_\eta(X, z, w)}$$

McFadden (8) has given the following argument that behaviorally justifies a special case of the general choice model. Suppose that the individual's choice index (e.g. utility, profit, net price, etc.) associated with the $\eta$th alternative is the sum of a nonstochastic part and zero-mean random variable, i.e.,

$$V_\eta + \epsilon_\eta$$

Here only the non-stochastic part depends on the $x_\eta$ and $z$, i.e., $V_\eta = V_\eta(x_\eta, z)$.

If we assume that the individual behaves so as to maximize his choice index, then we have

$$\text{Prob}\ \{y = \eta\} = \text{Prob}\ \{V_\nu + \epsilon_\nu < V_\eta + \epsilon_\eta, \forall \nu \neq \eta\}.$$

McFadden has shown that if the $\epsilon_\eta$'s are independent and with the distribution $\exp[-\exp(-\epsilon_\eta - \alpha_\eta)]$ where $\alpha_\eta$ is a parameter, then

$$\text{Prob}\ \{y = \eta\} = \frac{\exp\ [V_\eta(x_\eta, z) - \alpha_\eta]}{\sum_{\nu \in N} \exp\ [V_\nu(x_\nu, z) - \alpha_\nu]}$$

We now formulate the choice behavior of the elevator as a logit model. First, we replace the market-mode combinations $(j,m)$ by the index $\eta$. The location $i$ of the elevator is one of its characteristics and so we can replace the location index by a vector $z$ of the elevator's characteristics. We might want to include in $z$ such characteristics as capacity and ownership structure, as well as its location. Now define $V_\eta$ as the inner product

$$V_\eta \equiv \langle \beta_\eta, x_\eta^* \rangle \equiv \sum_\ell \beta_{\eta\ell} x^*_{\eta\ell}$$

where $\beta_\eta$ is a vector of coefficients and $x_\eta^*$ is a vector function of $x_\eta$ and $z$ with components that include $P_j$, $rT_{ijm}P_j$, $t_{ijm}$, $H^L_{ijm}$, $s_i d_m$. Thus the logit model for the elevator choice problem is

$$\text{Prob}\ \{y = \eta\} = \frac{\exp V_\eta(x_\eta, z)}{\sum_\nu \exp V_\nu(x_\nu, z)} = \frac{\exp \langle \beta_\eta, x_\eta^* \rangle}{\sum_\nu \exp \langle \beta_\nu, x_\nu^* \rangle}$$

Since the alternative $\eta$'s represent market-mode pairs, the above model is a multivariate logit rather than multinominal.

In this choice framework, the shipper selects the alternative with the highest choice index, and then uses marginal cost pricing to decide how much to ship. Predictions of the quantity shipped on the chosen alternative thus requires information about the firm's marginal cost curve. However, as stated above, surrogates for marginal cost pricing can be developed when information about costs is not available.

Let $Q$ denote the quantity to be shipped. Then, given the choice $y = \eta$, $Q$ is determined by $MC(Q) = V_\eta + \epsilon_\eta$. hence, its conditional distribution is

$$Pr[Q \leqslant q | y = \eta] = Pr[V_\eta + \epsilon_\eta \leqslant MC(q)]$$

$$= P_\eta(MC(q) - V_\eta)$$

where $P_\eta$ denotes the probability distribution of the error term $\epsilon_\eta$.

Now, let $Q_\eta$ denote the quantity distributed by alternative $\eta$. Its probability distribution is given by

$$Pr[Q_\eta \leqslant q] = Pr[Q \leqslant q | y = \eta]\, Pr[y = \eta]$$

$$= P_\eta(MC(q) - V_\eta) \cdot p_\eta.$$

Therefore, the expected quantity shipped by alternative $\eta$ is

$$E(Q_\eta) = p_\eta \int q\, dP_\eta(MC(q) - V_\eta).$$

Hence,

$$E(Q_\eta) = p_\eta E(Q | y = \eta). \tag{24}$$

Since $p_\eta$ is estimated by the choice model, then an estimate of $E(Q|y = \eta)$ used in (24) will yield an estimate of $E(Q_\eta)$. Since, in general, most elevators seek to maximize turnover of stock, then the real limit on shipment size (besides indivisibilities present in the system) is the quantity of grain available for distribution. Thus, one can estimate $E(Q|y = \eta)$ by estimating the quantity available for distribution.

We intend to estimate this model using data which are being collected in a survey of grain elevator shipping decisions. Since the choices essentially involve simultaneous selection of market and mode, the model calibration is more complicated than those usually applied to urban travel studies. However, several recent studies have suggested ways to estimate multivariate logit models (1, 2, and 11). In future research we shall try to apply these methods

to our model. We shall also try to develop new ways of handling simultaneous (multivariate) choice models.

## FOOTNOTE

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# Impacts on Agriculture from Market Pricing of Freight Car Services

Mary Berglund
Assistant Professor of Economics and Research Associate
in Agricultural Economics, University of Nebraska

The case for market pricing of rail freight car services rests on the relation between the utilization of the car fleet and the charges for the use of those cars. There is a general awareness that a problem exists with freight car supply—annual shortages occur during fall harvest, yet persistent idle capacity exists at other times of the year. Such poor car utilization is typically blamed on inadequate car investment by the railroads and/or general inefficiency of their operations. Evidence has shown, however, that much inefficiency in freight car utilization can be traced to uneconomic pricing of car services.[1]

Although a pricing problem can be identified, the car supply situation has many dimensions not amenable to simple solutions. The short-run problem involves non-optimal utilization and allocation of the existing fleet, while the long-run issue is that of non-optimal car investment and fleet size. Car utilization itself has both spatial and temporal aspects because rail traffic is unbalanced geographically and fluctuates seasonally. To complicate the matter, car supply is affected by the horizontal relationship among railroads—freight car interchange internal to the industry—as well as by the vertical relationship

between the shipper and carrier which is external to the rail industry. Although improvement in the latter relationship is our primary concern here, research suggests that car supply and its utilization will not be ideal unless the internal pricing and car distribution policies are corrected.

## CAR PRICING PROBLEMS

The impediments to efficient pricing result from existing institutional arrangements imposed by industry (the Association of American Railroads) and government (the Interstate Commerce Commission). The two administered "prices" for freight car use, per diem and demurrage, as well as the regulated "prices" for transportation services, freight tariffs, preclude the efficient use of the freight car supply—that use which maximizes its value to the rail industry, whether for transportation or nontransportation purposes. Price rigidities prevent car-owning roads from confronting either non-owning roads or shippers with the opportunity costs associated with seasonal shipping patterns. In times of car surplus, the most efficient use of cars may well be as warehouses rather than sitting idle, but inflexible per diem rates based on historical average costs make costs for such use prohibitive.[2] Conversely, in periods of car shortage, car-hire rates are too low to reflect the value of the cars for transportation purposes. An inflexible pricing system which endeavors to recover costs "on the average" or over time generates incorrect information signals (prices) which lead to non-optimal decisions on the use of resources.

### Pricing Problems in Car Interchange

Rail transportation in the United States consists of an integrated network characterized by private ownership of rail equipment and interconnecting rail lines. Efficient rail service requires the movement of freight cars from the lines of an owner onto the lines of other railroad companies, resulting in a great dispersion of equipment. Such a system requires that cars be returned to owning roads and that compensation be determined for the use of the cars and for any damage or repairs sustained while off-line. Unfortunately, the institutional means of solving car disposition and compensation has considered them as independent and unrelated problems. Car service rules, established in 1902, dictated loading and distribution of empty cars, while per diem became the accepted system of car-hire charges. Car rental rates recently set by the ICC have been legally enforceable, while certain car service rules were not mandatory until 1969.[3] Together, per diem and car service rules constitute the existing system of car management.[4]

Because two or more rail firms provide, jointly, the supply of through freight service, a direct interdependence of production exists. Inasmuch as connecting and terminating roads have effective control of cars, both loaded and empty, an involuntary rental system exists. Car interchange is further complicated by spatial imbalance in traffic flow, carriers in agricultural regions originating more traffic than they terminate, and temporal imbalance owing to seasonal fluctuations in rail shipping. Although the owners are compensated for the use of their cars, rental charges are seasonally inflexible and fail to reflect opportunity costs of cars to owners at different times of the year and at different geographical locations.

Car service rules were intended to promote prompt return of freight cars to owners, but violations have been the rule rather than the exception.[5] According to these rules, empty cars are to be dispatched in the direction of the owning road, loaded if possible or empty if a load is unavailable. Terminating lines are not to load their own cars in that direction if a foreign car is available. In practice, cars are often diverted by terminating roads for loading in directions other than toward the owning road, or sent home empty while the terminating road loads its own cars in that direction. The motivating factor is the relation of the rental charge to the opportunity cost of the car. Both interconnecting and terminating roads are responsible for car rental payments while foreign cars are on their line, and though they receive revenue for the loaded haul they receive no compensation for moving empty cars, yet are responsible for per diem.

Under such a system, the problem of car supply to a road terminating more traffic than it originates is a matter of how promptly it returns the foreign cars terminating on its line. During off-peak shipping periods, empty cars are sent home quickly to avoid per diem payments, creating empty car miles in the process; the per diem rate at such times is a burden to be avoided. During peak shipping periods, however, the per diem rental rate is a bargain to terminating roads able to divert foreign cars to their own use profitably. In effect, terminating roads can adjust the size of their capacity (car fleet) to their own volume of traffic without incurring the long term costs associated with car investment.

Originating and owning roads, on the other hand, must bear the risks of investment in equipment which spends a great percentage of time out of their control earning returns for other lines when cars are most valuable, but which may sit idle on home roads during other times of the year. This obligation for car investment rests on roads originating the greatest volume of traffic since they must maintain their car fleets to protect loadings. With car rental charges inflexible and often low, there is an incentive to divert cars at peak shipping periods; yet during off-peak periods these same charges preclude use of idle cars for non-transportation functions such as storage. Factor costs for car services paid by firms using

cars do not reflect opportunity costs to the rail industry.

Poor car utilization in car interchange is compounded by arbitrary regulations on freight car movement. Car service rules were originally intended to promote return of equipment to owning roads, providing the incentive for each road to maintain a fleet of sufficient size for its own needs. Such movement of empty equipment, however, is based entirely on ownership of the car, ignoring the fact that demand might exist for empty cars by roads elsewhere in the rail network. Currently, there is no institutional framework by which shippers or other railroads would know the location, or could contract with owning roads for use of empty cars. If the value of freight cars is to be maximized according to efficient allocative principles, some mechanism must permit cars to be utilized by the road or shipper having the greatest demand for them as expressed in prices for their services.

In theory, if terminating or other roads were to pay the optimal rent, reflecting opportunity costs of cars to owners, owning roads would be indifferent as to whether cars were diverted; car fleets would meet the most urgent demands in the rail network even though the majority of cars were owned by net originating roads. Off-peak use of otherwise excess car capacity also would be encouraged. Since opportunity costs vary by season and/or location, optimal rent requires that per diem rates be flexible.

Car service rules also need to be revised. Ownership, while being a rational basis for the control of cars, is nevertheless, an inefficient basis for routing cars in the rail network. The maximum utilization from a minimum amount of equipment requires routing empty cars to the nearest points of demand for loading. As an incentive to insure minimization of empty car mileage, free empty movement should be replaced with empty mileage charges.

To summarize pricing problems in car interchange: (1) impediments to efficient pricing of car services prevent car owners from confronting car users with the opportunity costs of these resources at different times of the year, and (2) car distribution based on the legal principle of ownership is inefficient. Losses to the rail industry from inefficient pricing of per diem cars and car service rules were estimated at $680 million for 1972 (2, pp. 90–111).

## Pricing Problems in Rail Service

Impediments to efficiency also result from rigid prices set for the transportation service, rail freight tariffs controlled by the ICC. Seasonal fluctuation in demand for rail transportation, coupled with inflexible transport charges mean that the level of car capacity required to meet peak demands is not fully utilized during the remainder of the year. When the rail tariffs are inflexible, peak shippers have no rate incentive to ship at other times of the year. Conversely, off-peak shipping may be low precisely because inflexible rates are high in relation to the value of the service.

In one sense the rail industry is analogous to a public utility which must maintain capacity for peak loads. A problem arises because of durable assets, non-storable services, and periodic fluctuations in demand over time. In such cases, pricing of the service becomes critical. Correct pricing principles require rates based on costs of providing the supply during various periods, including capacity costs.[6] Thus, customers creating peak demands would bear the marginal costs of adequate capacity to serve the peak, in addition to variable costs.

In the case of rail transport, seasonally inflexible tariffs prevent carriers from confronting shippers with the costs of peak capacity, generating a non-optimal quantity demanded since there is no rate incentive to use the service economically. Off-peak users of the service are forced to subsidize peak users by paying rail rates which include provision of peak capacity. The two pricing problems reinforce each other—a non-optimal fleet size exists, owing to railroads' attempts to provide peak capacity, and this non-optimal fleet is poorly utilized because of car compensation and disposition rules. Rail losses from idle car days were estimated to range from $1.8 to $186 million in 1972 (2, pp. 112–133).

The situation suggests that some form of peak-load pricing, not widely used in the United States despite its success in Europe, would be efficient. Such a system is based on charges to customers which reflect marginal operating costs plus a charge which is related to the availability of capacity (or reflects congestion costs which are ignored here).[7] Rate differentials based on the cost of providing capacity create incentives to transfer demand from one period to another whenever possible. In the case of freight transportation, if provision of the service can be adjusted by commodity storage and/or the use of excess capacity at off-peak, time-variable fluctuations in demand may be evened, achieving greater utilization of capacity in the short run and reduction of investment costs in the long run.

Inflexible pricing structures, based on recovering average costs over some time period, may compensate carriers in general, but they cannot accomplish the transfer of demand from one time period to another. As a result, demand is not adjusted optimally from a social point of view. It is likely to be too high in peak periods because the service is undervalued, and low in the off-peak when the service is over-valued. When railroads can confront shippers with true costs of shipping at various time periods, car supply will approach the optimal.

## Additional Results of Price Rigidities

In times of car shortage when car-hire charges and freight tariffs cannot function as equilibrating alloca-

tion mechanisms between car supply and demand, arbitrary methods must be used to ration the short supply. Such methods typically occur in situations where legal "ceiling" prices exist. Car allocation may occur by formal rules such as special car service orders issued by the ICC or intervention by state regulatory commissions to force "equitable" car distribution between large and small shippers within their states. Or railroads may allocate cars according to informal rules such as "first come, first served," (with or without limiting quantities to shippers), historical purchasing patterns of shippers, or for nonmonetary considerations such as favoritism. Another allocation alternative in times of short supply, a "black market" in cars, allegedly occurred recently in the grain industry and has been investigated by the ICC.

The point is that some arbitrary rationing method for cars must be used and it is not unreasonable to assume that railroads would protect their high volume, regular traffic at the expense of the small agricultural shipper. Although the social costs of price instability in agriculture are commonly cited, little attention is given to the costs of price rigidities. Queuing costs suffered by small shippers and consignees could be substantial, depending upon the severity and duration of the car shortage (as well as availability and cost of other transportation).

Queuing costs depend upon shippers' responses to delays in receiving cars at the time and of the type requested. Waiting for a preferred type of car increases storage and inventory costs; accepting a substitute type of car often requires additional packing or loading costs; substituting another mode usually results in increased costs. Estimates of these annual costs for grain shippers were made in a 1968 study, showing total direct costs to be from $14 to $17 million (12). (Grain consignees were estimated to suffer annual costs from $1.7 to $5.9 million).

Another result of improper pricing—the inadequacy of rental charges to reflect the opportunity costs of car ownership—has been the trend toward highly specialized cars. Such cars, as well as privately-owned equipment, move under special dispensation from the ICC so that they cannot be loaded by terminating or connecting railroads and thus return empty to owners. Although unnecessary empty car mileage is incurred, rail and other firms evidently prefer the poor utilization of empty backhaul, with control, to possible diversion of general-purpose per diem cars for indeterminate time periods. Obviously, shippers currently are paying tariffs reflecting this poor car utilization. Small shippers who are unable to afford the necessary investment in private cars are likely to find their service deteriorating as numbers of general-purpose cars decline and railroads concentrate on moving specialized and private equipment. An efficient, minimum-energy use rail network would require extensive use of general-purpose cars capable of loading many commodities to minimize empty mileage, yet this type of car is subject to diversion and therefore unattractive from an owner's point of view.

## A RENTAL MARKET FOR FREIGHT CAR SERVICES

The idea of a freight car rental exchange proposed by J. R. Felton in a 1970 monograph and subsequently expanded upon in a report to the Association of American Railroads in 1974, has great appeal because it simultaneously solves the internal pricing problem of freight car interchange and the external pricing problem of the rail service (5 and 6). In addition, market pricing of freight car services alleviates both the spatial and temporal difficulties in car utilization. In the short run it should move the rail industry toward an optimal allocation of the existing fleet, and in the long run it should result in an optimal size car fleet. The institutional mechanism could be a teletype auction.

If shippers were allowed to participate, bids in a car market would have the potential for reflecting opportunity costs of cars in different locations and at different times of the year, generating optimal rent for car use. In addition, rental rates for car services would provide a flexible element in total transport charges which would reflect seasonal variation in car value so that peak shippers would incur the costs of peak capacity provision. Pricing of car use through a rental market could accomplish this without affecting existing regulation of freight tariffs, providing *de-facto* peak-load pricing. Peak demand would be adjusted if it can be shifted; otherwise, the peak price would still cover all costs associated with peak traffic.

The effect of an inflexible freight rate plus a seasonally flexible car-use charge is similar to a two-part tariff. Market determined rental rates for car use would vary with the seasonal demand for cars and would act as an incentive to depress peak shipping. Currently the railroads' rate system provides a mileage allowance as an offset against the freight tariff when shippers furnish their own cars. In periods of heavy demand, car rental rates would be bid up to the point that railroads' revenue would be greater under the mileage allowance that if they provided cars; roads would then enter their cars in the rental market and require shippers to provide cars. Shippers would then bid in the rental market for cars and receive mileage allowances from railroads. This would allow railroads to confront shippers with peak car rental rates based on costs of providing peak capacity, creating an incentive to shift demand to off-peak periods.

In off-peak periods, car rental rates would fall to the level that shippers would prefer to receive mileage allowances and provide cars. Inasmuch as shippers could rent cars from other railroads, private

car companies, or other shippers, the rental market would tend toward a competitive one. During off-peak, railroads would tend to put cars into the rental market even at low rates, preferring to receive minimal rents rather than allow cars to sit idle. Low rental rates for car use in such periods would provide additional incentive for peak demand to shift, thereby eliminating unallocated car days. The middle range of car rental rates might find railroads providing their own cars to avoid transaction costs in the rental market.

Market pricing of car services in car interchange would confront roads diverting foreign cars with the opportunity cost of those cars, allowing car owners to appropriate the benefits of their investment. If empty cars were no longer routed by car service rules, they could move in accordance with demand for their services as reflected in rental bids, eliminating excessive empty mileage. The reduction in empty car miles would result from (1) allowing cars to move to nearest points of effective demand regardless of ownership; (2) eliminating unnecessary empty miles by railroads anxious to shift per diem payments; and (3) short-routing cars back to owners should they choose not to enter them in the market.

If cars were rented on an f.o.b. basis so that the renter would have to pay empty mileage charges to all carriers moving the empty cars from the point where they were made empty to the loading point, empty cars would generally move to the nearest point of car deficit to minimize the empty mileage charge. The car exchange would provide information on the location, type, and condition of cars for prospective bidders. Even if cars made empty on terminating lines were not rented, terminating roads would have no incentive to send them home since they would be relieved of per diem payments; cars would remain on their lines (for reasonable storage fees) until notified by owners to move to points for loading. Finally, should owning roads want cars returned rather then entering them in the rental market, cars would travel the shortest route with owners responsible for empty mileage payments to all participating roads. Charges for empty mileage would provide an incentive for its minimization not found in the present system.

Although the mechanics of the teletype auction for generating optimal car rents have been discussed in detail elsewhere, a few comments are in order here. The advantage of an electronic auction is that it conforms closely to desirable attributes of a perfect market. The teletype system eliminates the necessity for the bidder, the seller, and the product to be in the same location, making it adaptable to the needs of renting spatially separated freight cars made empty at terminal locations.[8]

In addition to overcoming the spatial problem, the teletype auction satisfies several important conditions of a competitive market, many of which benefit agricultural shippers: (1) owners and users of freight car services have perfect knowledge of the price and the location of all freight cars available for rent, (2) electronic communication insures that all competitors have an equal opportunity to make rental bids, so that individual influence on pricing is kept to a minimum, (3) costs associated with assembling buyers, sellers and product are eliminated if the item is sufficiently homogeneous or can be "graded," (4) maximum rental prices established by a Dutch auction process reduce possible exercise of monopsony power, and (5) cars are priced accurately on the basis of their opportunity costs to owners, reflecting both efficiency and equity.[9]

Because advantages of market pricing for car use depend on knowledge of the information signal, price, only electronic communication could achieve a market of the size necessary to auction car services. A large market would help to equalize bargaining power since it would be difficult to influence prices by altering either market supply or demand. Maximum competition among bidders for cars would help to insure that efficient prices were generated; only the teletype auction provides equal opportunity to bid on cars simultaneously. By renting on a specification basis (assuming cars were accurately graded as to condition), the rental price would likely be an accurate reflection of the value of the car.

Although a market can be created for car services, the current regulatory environment precludes the use of the market mechanism to set freight rates. If railroads were relieved of their common carrier obligations to supply rail cars, however, the capacity costs associated with car supply could be effectively separated from the actual transportation service so that car-use charges would reflect car opportunity costs. Since it is entirely possible that car investment is not profitable for all railroad companies at intermodally-competitive freight rates, a partial disintegration of transportation functions would allow railroads to concentrate managerial talent and capital on the provision of low cost reliable transport service while car investment was left to shippers, private car companies, or financially sound railroads. Car ownership would then be placed in the proper economic perspective—it would either earn a competitive rate of return for car owners in the long run or it would constitute a non-optimal use of resources by owners.

## BENEFITS FROM FLEXIBLE CAR PRICING

Some estimates of potential gains from market pricing of boxcar services were made, assuming that a car auction would generate efficient prices. These benefits follow from the internalization of externalities imposed by existing institutional pricing and car distribution policies. Inasmuch as demand under the new system would have been difficult to predict ex ante, a supply analysis was used. If costs to rail

firms of supplying a given level of transport demand (in this case, 1972 boxcar traffic) were less under an alternative pricing system than with current car management methods, this cost difference would accrue as savings to the rail industry from market pricing. Costs of implementation and adjustment were not estimated, but these would represent some offset to savings.

Monetary savings resulting from a pricing correction were significant.[10] Eliminating annual costs of unnecessary empty boxcar mileage plus an annual investment reduction in new cars owing to improved car utilization generated a savings of $680 million for 1972. Savings from smoothing seasonal peaks depended upon assumptions regarding excess capacity; an upper limit estimated investment savings if traffic could be exactly evened (an unrealistic situation), while the lower limit estimated opportunity costs of idle cars as storage. These savings ranged from $1.8 million to $186.7 million. For 1972, the total savings ranged from $682 to $867 million, which were slightly larger than the net railway operating income of Class I railroads that year ($852 million). These gains, from boxcars alone, were approximately 6.6 percent of Class I freight revenues in 1972 ($13 billion) and 30 percent of net operating revenues ($2.8 billion). Felton estimated additional savings of $70 million if existing demurrage rules were abolished and car detention related to rents were generated in a car rental auction (7).

## Benefits to Agricultural Shippers

The impact of market pricing for shippers depends to a great extent on how railroads would distribute cost savings, but the greatest improvement should follow from increased car availability. In addition to monetary savings from more efficient car utilization, it was found that railroads could have accomplished 1972 boxcar traffic with only 57% of the existing fleet. Allocating cars in the rail network on the basis of demand, regardless of ownership (the spatial dimension), and smoothing of seasonal peaks (the temporal dimension), allowed 1972 traffic to be accomplished with fewer cars. In the short run there would be an effectively larger car supply until adjustment was made to optimal, long-run fleet size. This temporary "solution" to the car shortage, however, cannot be considered permanent. The economic solution follows from flexible prices generated by a car market—cars are allocated by the price mechanism to those who have the highest valuation of the resources as expressed in the rental bid. As with any market results, existence of an "equilibrium" price does not mean that *all* demand for cars has been satisfied—only the excess demand at that price. Nor does the car market necessarily guarantee an optimal allocation of cars to *all* shippers. The allocation can be assumed efficient only for those traders bidding in the market for car services.

Any direct monetary benefits to agricultural shippers are somewhat conjectural at this point. If the rail industry were earning a competitive rate of return, redistribution of cost savings to shippers in the form of lower freight tariffs might be anticipated, particularly in view of intermodal competition. The potential impact of market pricing of car services on the level of car rental charges and total transport costs is not entirely predictable at this time. It is premature, however, to assume that flexible car-hire charges would mean substantially higher transport costs for peak shippers. Obviously, the *relative* relation of peak to off-peak charges results in higher peak charges, but the absolute level is another matter. Inasmuch as car utilization would be improved and car rental charges would no longer reflect large quantities of idle car days and excessive empty car miles, optimal car rents might well be below present levels even at peak periods. Should increased car availability result in diversion of other freight traffic to rails, this prospect is enhanced. Certainly off-peak transport costs would be substantially lower so that agricultural shippers could cover storage costs and still lower total shipping costs.

The greatest impact on agriculture is expected to be the increase in car availability or, alternatively, the reduction in uncertainty regarding car orders. Studies at Massachusetts Institute of Technology indicate that reliability plays an important role in the shipper's choice of mode (9). Rail has a longer average transit time than highway carriers, but the *variability* of transit time is a more important factor in the adjustment of shipper/consignee inventories than is *average* transit time (9). Reduction in variability, or unreliability, for rail should follow from improved car utilization and from participation by shippers in the car market. Existing methods of arbitrary car allocation would be replaced by impersonal market forces. Since small shippers have neither the volume, regularity nor concentration of destination points to warrant preferential treatment in filling car orders at present, they would probably be among the greatest beneficiaries of market pricing.

The advantage of a teletype auction system would be that it allows broader participation in the car allocation decision. Widespread participation should mitigate any erratic or arbitrary price movements which might occur in a regional car exchange or in bilateral negotiations. A certain range of price movement, however, is a desired result, yet it should be related to an imbalance of supply and demand rather than possession of market power. Larger geographical markets and numbers of participants allowed by electronic communication would weaken the influence of dominant bidders. Agricultural economists are concerned, and rightly so, with price stability, but the severity of disequilibrium problems in car supply associated with price rigidities for car services is of a magnitude that requires re-

examination of existing pricing policies. Uncertainties for shippers also exist when freight cars are unavailable; a trade-off of increased car certainty for variability of transport costs may be desirable.

## FOOTNOTES

[1]These and other results reported in this paper are from (2).
[2]Per diem is used to refer to the entire structure of basic car-rental charges which include a mileage element as well as daily charges. Age and value of the car are included in the structure of rates.
[3]Car Service Rules 1, 2, 6, 7, 15, 16, 17, and 18 were those specified by the ICC as mandatory. *Ex Parte 241*, 335 ICC 264 (1969), pp. 285 and 309.
[4]These are supplemented by special car service orders which are often imposed by the ICC to alleviate localized car shortages during peak shipping periods, but also relate to specific car-loading practices, delay of cars, or other inefficient practices affecting car distribution. The AAR's Car Service Division can also issue car service orders.
[5]An AAR study found that only 60 percent of car movements in 1969 conformed to car service rules (1).
[6]Discussions of the correct orientation of consumer choices by means of pricing policies are contained in (3 and 4).
[7]The literature on peak-load pricing is too extensive to cite here; for specific application to transport pricing see (10 and 11).
[8]The electronic auction employing a master teletype machine at a central "selling" agency and many "buying" machines elsewhere, is used to market hogs in Canada. Research is in progress at the University of Nebraska to study its adaptation to a market for freight car services.
[9]These advantages of a teletype auction and a comparison of its pricing efficiency with other selling methods are discussed in (8).
[10]The complete methodology for estimation of the savings is found in (2, Ch. 6). An abbreviated discussion will appear in the May 1977 issue of *Land Economics*.

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# Impacts of Motor Carrier Deregulation on Agriculture, Rural Shippers, and Receivers


John Richard Felton and Dale G. Anderson
Professors of Economics and of Agricultural Economics, respectively,
University of Nebraska


For the last five years or so, bills proposing some substantial deregulation of highway carriers of freight have regularly been introduced into Congress. The most recent goes by the name of Motor Carrier Reform Act of 1976. Were it to be enacted it would, among other things, greatly restrict the collective rate-making activities of rate bureaus; curb the power of the Interstate Commerce Commission to prohibit trip leasing by private carriers; require the Commission to issue a certificate where it appeared that an applicant could cover his costs, irrespective of the effect of such entry upon existing carriers;

restrict the power of the Commission to investigate and suspend proposed rates; define compensatory rates as equal to variable costs and prohibit the Commission from mandating rates in excess thereof; transfer authority over highway mergers to the Department of Justice; and permit small uncertificated agricultural haulers, under certain conditions, to engage in the transportation of non-exempt commodities on backhauls.

While this proposal falls considerably short of deregulation of the trucking industry, it moves sufficiently far in that direction to generate bitter opposition from the American Trucking Associations. The president of the ATA declared that the bill was the "ultimate in governmental irresponsibility [and that its passage] would not only destroy essential stability in transportation but would completely disrupt the nation's entire marketing and distribution system (19).

Without predicting the passage of the Motor Carrier Reform bill or any other deregulation measure, it would seem appropriate to assess the probable impacts of deregulation on the agricultural sector and the larger rural community of which it is a part. Admittedly, the effects will differ with the nature and the extent of regulatory relaxation. In order to render analysis feasible, however, it will be assumed here that economic regulation of motor freight transportation is abolished *in toto*. It is our task to set forth the probable consequences of such action. Specifically, in this paper we will consider the probable organization of the trucking industry in an unregulated environment, foreign experience with deregulation, empirical studies of the cost of regulation, and propose simulation study of the effects of deregulation.

## THE ORGANIZATION OF THE TRUCKING INDUSTRY IN AN UNREGULATED ENVIRONMENT

Just as the performance of an industry is the product of industry structure and behavior, so are the latter, in turn, influenced by technology. The obvious technological characteristics of the motor freight industry which most influence its structure are the suitability of the way for multi-firm operation, the relatively small load and vehicle units, and the relatively simple nature of industry operations. The ability of the way to accommodate the vehicles of many firms has encouraged separate ownership of way and vehicle and has promoted flexibility and geographic mobility in the provision of motor freight service. The relatively small capacity of even the largest motor vehicle limits scale economies associated with vehicle size and reduces entry barriers related to capital requirements. The relatively simple technology is also conducive to easy entry into the industry.

Given the demand for transportation for all the various commodities in the United States and the comparative costs of the different modes, a large number of motor vehicles will be necessary to bring supply into equilibrium with demand. Unless there are important economies of scale or promotional advantages of large size, technology and demand should be consistent with the presence of a large number of firms within the industry.

Several studies would suggest that there are substantial economies of scale associated with vehicle size (for examples, see 14 and 20). Once a firm owns a vehicle of efficient size, however, it is not so clear that the multiplication of such vehicles will yield any significant additional economies. Certainly the empirical studies, to date, do not provide any definitive evidence of such economies.

The most numerous studies of scale economies in trucking are cross-sectional analyses of firms of different sizes, using cost per ton-mile or per vehicle-mile as a measure of efficiency. The two best known contributions, perhaps, were those of Merrill J. Roberts and Robert A. Nelson, two decades ago now (13 and 12). Despite the fact that unit operating costs declined with increasing firm size, neither writer attributed this inverse relationship of size and cost to size *per se*. They noted that larger firms *on the average* enjoyed longer hauls, carried larger loads, and achieved a greater number of vehicle miles per route mile. When the sample was confined to firms with similar haul, load, and route utilization characteristics, the apparent association between larger size and smaller operating costs disappeared.

By the way of contrast, Michael Chisholm's study of milk transport operations in England and Wales revealed that the smallest of six size classes of firms had the lowest costs and the largest of the classes had the highest cost (3). This did not demonstrate diseconomies of scale, however, anymore than the Roberts and Nelson studies demonstrated economies of scale. In the case of the milk haulers, the largest firms collected the fewest gallons of milk per farm and achieved the fewest gallons per vehicle mile of any of the six size groups. These factors, rather than diseconomies of scale, appeared to account for the poor showing of the largest milk haulage firms.

More recent statistical-econometric studies of economies of scale in highway freight transport have been interpreted as more supportive of the hypothesis that scale economies are present in the industry. Stanley L. Warner discovered that about two-thirds of the firms which improved their operating ratios between 1955 and 1960 had increased their output, while about two-thirds of the firms which experienced poorer operating ratios during this same period reduced their output (21). From this he concluded that economies of scale did, indeed, occur in road haulage.

Quite apart from the fact that operating ratios are influenced by revenues, as well as costs, Warner's

study exhibits a far more fundamental defect in that it fails to make a distinction between the influences of *scale* and of *utilization* on the expense component of the operating ratio. In short, there is no way to distinguish changes in output which involve movement along the long-run average cost curve from those along the short-run average cost curve. As a consequence, Warner's conclusion that "two-thirds of the observations suggested economies of scale" (21, pp. 38–39) must be rejected.

The most sophisticated econometric study of economies of scale in the trucking industry was probably the one undertaken a couple of years ago by Ladenson and Stoga (8, pp. 390–396). They endeavored to fit cross-sectional data on ton-miles accomplished by a sample of 116 common carriers of general freight to a Cobb-Douglas production function. Using the number of employees as a measure of size, they found constant returns to scale for firms with fewer than 50 employees and increasing returns to scale for firms with 50 or more employees. They concluded that, if there was an optimum size, "this size is greater than the current size of the largest American trucking firms" (8, p. 395).

Such a finding renders the Ladenson and Stoga study suspect on the face of it since it is inconsistent with the low concentration which characterizes the industry. If the optimum size is indeed larger than any existing trucking firms, what has prevented them from achieving such a size? Regulation can hardly be the culprit inasmuch as American regulation has imposed no limits on internal growth and has placed little, if any, restriction on growth by merger. Moreover, firms transporting exempt agricultural commodities tend, on the average, to be smaller than firms engaged in transporting regulated commodities (9).

The basic weakness in the Ladenson and Stoga study is that it utilizes ton-miles as the sole measure of output. As noted earlier, Roberts and Nelson both objected to ton-mile and vehicle-mile cost relationship as a unique measure of efficiency on the ground that larger firms generally carried larger loads longer distances than did smaller firms. By ignoring this systematic bias in the data, Ladenson and Stoga reached a dubious conclusion.

A second type of study, utilizing an economic-engineering approach, has been popular with agricultural economists.[1] This method calls for the development of model firms of different sizes but with identical commodities, vehicles, hours of operation, pay scales, utilization, and so on. These studies rely on survey data to provide order-of-magnitude cost information, but they remain sensitive to the assumptions made with respect to supervisory personnel, fleet discounts, maintenance expenses, and so on. At the same time, they tend to dismiss the possibility that managerial diseconomies might ultimately establish limits to enhanced efficiency. As a consequence, these studies implicitly suggest that unit costs continue to decline indefinitely, albeit at a decreasing rate, with increasing firm size. In the final analysis, the existence of economies of scale is an empirical question which cannot be resolved by assumption.

A third type of study, the "survivor technique," employs a methodology first proposed by George J. Stigler (18). This technique is based on the proposition that firms in an efficient size class will increase in numbers and contribute an increasing percentage of industry output, while firms of sub-optimum or supra-optimum size will decline in relative importance. Thomas Gale Moore in his recent comparative study of regulation in five European countries utilized the survivor technique to identify minimum efficient size of trucking enterprise (11). Defining such size as the smallest size group which grew in numbers of firms over some period of years, he found substantial variation from country to country. Somewhat surprisingly, perhaps, minimum efficient size was the smallest, four to six vehicles, in Germany, the country with the most stringent regulation, and the largest, 31 to 50 vehicles, in Great Britain, the country with the least regulation of the trucking industry (11, p. 124).

The principal explanation of this association between regulation and firm size is that much European regulation is oriented toward capacity control of existing firms, a kind of regulation that is unknown in the United States. At any rate, regulation so influences firm size that only in Great Britain would the survivor technique appear to be of appreciable value as an indicator of efficient size. Furthermore, according to Moore's own data, trucking firms in Great Britain with five to ten employees, say four to eight trucks, grew very rapidly in numbers between 1969 and 1972 and, thus, would have merited the designation "minimum efficient size" pursuant to his own definition of "surviving."

While the definitive study of scale economies in trucking has yet to be performed, the studies which allege such economies are generally less convincing than those which question their existence. Given the size of the industry and the ease with which intermarket transference of resources can occur, it would appear that only very substantial economies of scale would prevent the motor carrier industry from being workably competitive in the absence of economic regulation.

## MOTOR CARRIER DEREGULATION IN AUSTRALIA AND GREAT BRITAIN

Insight as to the impact of deregulation of trucking in the United States can also be gathered from a review of foreign experience. Australia and Great Britain, perhaps, provide the best examples of countries which reduced drastically, if they did not eliminate entirely, economic regulation of the industry.

Canada is a somewhat less clear-cut example, with considerable difference of opinion among the authorities as to the extent to which *de jure* or *de facto* deregulation has occurred in the various provinces (15, pp, 322–334).

In Australia, economic regulation of intrastate trucking is within the discretion of the individual states. Prior to 1954, the states also regulated interstate trucking pursuant to whatever policies and rules were applicable with respect to intrastate operations. In 1954, however, the Judicial Committee of the Privy Council held that state regulation of interstate trucking contravened the constitution. Since then, intrastate truck transportation has been free from both state and federal regulation. Furthermore, in at least some of the states, e.g., New South Wales, such economic regulation as does exist has not affected adversely intramodal competition (7, pp. 137–138).

The deregulation of interstate trucking apparently ushered in a period of rate instability and an increase in the number of bankruptcies. By the early 1960's, the most important constituent of the interstate trucking industry was the owner-operated trucking firm. According to Stewart Joy there are about 2,000 such firms in the interstate trucking business, operating after the fashion of tramp steamers by subcontracting with larger firms (6, p. 278).

Joy and Kolsen are in agreement that in the large interstate markets pure competition prevails (6, p. 285; and 7, p. 137). Rates are associated with the loading characteristics of the commodity and distance travelled. Rates vary seasonally, and trucking resources shift in and out of particular markets based on seasonal and other fluctuations in the demand for transport service. While at least some of the states limit road-rail competition by imposing ton-mile taxes on highway carriers, this taxation has little influence on intra-modal highway carrier competition since the taxes are applicable to all highway carriers, for-hire and private alike (3, pp. 137–138).

On the other hand, Joy contends that in the markets with smaller potential volume of traffic, whether attributable to the specialized nature of the commodity, to the small shipment size, or to low population density, oligopolistic markets of rather low concentration, rather than purely competitive ones, tend to prevail. As Joy puts it:

> The lower volumes of traffic available, the smaller number of buyers, and the fluctuations of demand as between buyers, confer limited economies of scale through the ability of a multi-vehicle firm to schedule its work more efficiently. Thus, by pricing at or near the rail rate, the country hauliers gain a rent of location for their local knowledge, but such rents are subject to upper limits by the threat of new entrants who would share existing traffic at existing prices (6, p. 285).

Oligopoly is not, of course, a sufficient condition for the realization of pure profits and neither are economies of scale in a market which is so small that not even one firm can attain optimum size. At any rate, unless economies of scale are substantial, the ease with which new or existing carriers can enter any profitable markets will tend to minimize any supra-normal profits to trucking firms, whatever the nature and volume of commodities to be transported and whatever the origins and destinations.

From 1933 to 1968, Great Britain employed entry controls as the sole means of economic regulation. Licenses awarded to vehicles operated by professional truckers contained no commodity, route, or point restrictions, but the license did specify the principal shipper to whose shipments the vehicle was dedicated. Those "A" licenses, as they were called, acquired considerable value because of limitations in their numbers. A second variety, the "B" license, was issued to private carriers wishing to engage in for-hire carriage as a complement to the transportation of their own goods. While licensing authorities were considerably more willing to issue "B" than "A" licenses, they did impose numerous restrictions on the former, such as area or persons to be served and commodities which might be transported.[2]

With the passage of the Transport Act of 1968, all economic regulation of motor freight transportation in Great Britain was to cease after November, 1970. Operators must meet certain safety and financial responsibility requirements, but, beyond that, a truck operator, whether for-hire or private, is free to carry any commodity from any point to any other point by whatever route he chooses and at whatever rate is mutually agreeable.

Inasmuch as economic regulation in Great Britain prior to 1968 did not utilize the commodity, route, and point restrictions characteristic of American regulation, it might be presumed that British entry controls would increase rates but not costs. Moore's study of the impact of deregulation in Great Britain, however, does suggest that entry controls elevated costs to some extent. The reason is that while real truck rates declined by about 10 percent in 1972 and 1973 over earlier years, (11, p. 37), profits as a percentage of total assets actually increased in 1971 and 1972 over earlier years (11, p. 24). This suggests that deregulation may well have eliminated some regulation-induced "X" inefficiency.

## THE COSTS OF HIGHWAY CARRIER REGULATION

Quite apart from the explicit costs of regulation represented by the costs incurred by the regulatory agency in imposing regulation and by the carriers in complying with regulatory requirements, regulation elevates transport costs in a number of ways. First, restrictions on entry into the industry enable existing firms to impose rates in excess of a competitive level

and may promote "X" inefficiency by blunting incentives for efficient operation. Second, commodity, route, point, and area restrictions tend to reduce average loads, increase empty mileage, add to vehicle revenue miles without enhancing revenue, and restrict greatly the possibilities of potential competition through inter-market transference of motor vehicles. Third, rate control encourages non-price competition and the increased capacity which such competition engenders. Fourth, rate control also encourages the acquisition of excess capacity by preventing rates from responding to seasonal fluctuations in demand.

A number of attempts have been made to measure the impact of economic regulation upon transport costs, in general, and highway carrier costs, in particular. One series of studies by Snitzler and Byrne of the U.S. Department of Agriculture grew out of U.S. Supreme Court decisions which held fresh and frozen poultry and frozen fruits and vegetables to be non-manufactured agricultural commodities within the meaning of the Motor Carrier Act of 1935 (16 and 17). The results of these "before and after" studies have been well-summarized by Walter Miklius (10). In twelve major markets, fresh poultry rates after deregulation declined by 12 to 53 percent, with an average of 33 percent, while frozen poultry rates declined by 16 to 59 percent, with an average of 36 percent. Furthermore, "stop-off" charges of $5 to $15 per stop were either reduced or eliminated altogether. Insofar as frozen fruit and vegetables were concerned, truck rates declined an average of 19 percent at a time when rail rates were rising by 6 to 14 percent. Again, stop-off charges of $8 to $12 per stop were generally reduced to about $5 per stop (10, pp. 4–5).

Customer satisfaction with truck service is more than a matter of comparative rates. Willingness of the carrier to serve out-of-the-way origins and destinations and to settle loss and damage claims, speed of service, and so on are all relevant to an over-all appraisal of the relative merits of regulated and exempt carriage. For both fresh and frozen poultry and frozen fruits and vegetables, a substantial majority of the shippers found the disadvantages of regulated carriage to outweigh the advantages and the advantages of exempt carriage to outweigh the disadvantages (10, p. 5).

In contrast to the U.S.D.A.'s "before and after" study, Richard N. Farmer compared the costs and revenues of regulated and exempt carriers (4). Both the revenues and costs of regulated common and contract carriers exceeded those of the exempt carriers by 2/3 or more. Only a part of the explanation can be found in average tons per load, however, where the exempt carriers outperformed the regulated carriers by 2/5 or more. As noted previously, reductions in vehicle payload is only one of the disabilities occasioned by regulation. A final observation on the Farmer study is that, despite the much greater revenues per ton-mile earned by the regulated carriers, costs per mile were higher still, so that exempt carriers' net revenue per ton mile was greater than that of any of the regulated groups.

James Sloss has attempted to measure the effect of regulation on motor carrier rates by comparing revenues per ton-mile in "regulating" and "non-regulating" Canadian provinces (15). While classification of provinces in this fashion proved far from simple, Sloss made his allocation pursuant to the following criterion: "Failure to regulate either entry or price, due to legislative policy or administrative discretion, justifies here the designation of 'non-regulation' for the industry and the province (15).

The hypothesis which Sloss endeavored to test was that "in Canadian provinces regulating intra-provincial motor haulage, the rates received by intercity trucking firms exceeded those of firms providing service in non-regulating provinces, with due regard for dissimilarities of costs" (15, p. 335). Thus, Sloss included as independent variables in his multiple-regression equations: average length of haul, average net weight per loaded vehicle, average fuel tax per gallon, average license cost per truck or tractor per year, and average annual wage per employee (15, p. 342). The null hypothesis that average revenue per ton mile was unaffected by regulation was rejected on the ground that the mean excess of the residuals in the regulated provinces was about seven-eights of a cent per ton mile (15, p. 344).

Sloss then compared Canadian "unregulated" provinces with Canadian "regulated" provinces and the United States, combined. After accounting for differences based on average length of haul, average net weight per load, average annual license cost per truck or tractor, and average annual wage per employee, Sloss found that regulation was associated with a four-ninths cent increase in per ton-mile revenues of trucking firms during the period 1958–63 (15, p. 350). As he puts it: "Had regulation not been applied to U.S. common carriers, it may be surmised that their revenues per ton-mile would have been reduced by this 6.73 percent" (15, p. 351).

The major shortcoming of Sloss' technique for measuring the effect of regulation on carrier revenues per ton-mile is that regulation may affect the values of the independent variables, particularly the average length of haul and average net weight per load. As a consequence, much of the regulation-induced impact on costs may have gone unmeasured. This would go a long way toward reconciling Sloss' estimate that regulation raised rates by only about 6.7 percent with Farmer's estimate that regulation raised rates by 67 percent or more!

Moore has also attempted to provide a rough estimate of the effect of regulation on truck costs and rates in the United States on the basis of his comparative study of European regulation. He notes that Great Britain and West Germany provide the greatest contrast among the five countries he studied

and that West Germany's regulatory scheme rivals that of the United States in its stringency. Minimum and maximum rates are subject to governmental control, and entry is so difficult that it is almost always accomplished by the transfer of existing operating authorities (11, p. 122). Moore found that, despite the generally greater efficiency of the West German economy, empty truck mileage was significantly greater in West Germany than in Great Britain. In West Germany the trucks driven by for-hire operators were empty 45 percent of the time and by private operators, 66 percent of the time (11, p. 128). By way of contrast, empty mileage for for-hire and private carriers in Great Britain was 34 percent and 30 percent, respectively (11, p. 126).

Insofar as the United States is concerned, Moore notes that truck rates per ton mile in Great Britain, Belgium, the Netherlands, and Sweden are 43 percent lower than in the United States (11, p. 141). While wages in the United States are higher than in these countries, fuel costs are considerably lower and operating conditions generally superior. It is Moore's conclusion: "Where there is strict regulation, such as in West Germany and the United States, rates are higher—about 40 to 50 percent in both cases—than the rates charged in unregulated sectors or in nonregulated economies" (11, p. 145).

On the basis of these studies, it would appear that the effect of regulation on highway carrier cost and rates is certainly something more than *de minimis*. As a matter of fact the elevation of cost and rates is of such an order of magnitude that minor methodological shortcomings can scarcely obscure the inefficiencies inherent in the kind of economic regulation practiced in the United States.

## PREDICTED EFFECTS OF DEREGULATION ON AGRICULTURE, RURAL SHIPPERS AND RECEIVERS

A recurring contention of the proponents of the present regulatory scheme is that deregulation will occasion a considerable deterioration in the highway carrier service available to isolated rural communities and to small shippers and receivers. On the basis of the inherent structure of the trucking industry, there are a number of reasons for doubting this prediction:

1. The U.S.D.A. studies suggest that deregulation of carriers transporting fresh and frozen poultry and frozen fruits and vegetables led to increased shipper satisfaction with the service rendered (16 and 17).

2. The mere fact that regulation may permit carriers to generate excess revenues in some transport activities provides regulated carriers with no incentive to dissipate those revenues by serving small, out-of-the-way shippers at a loss. Nor does the common carrier obligation of service insure that money-losing services will, in fact, be performed. As Gilbert L. Gifford has commented:

> A growing number of motor carriers, seeking to avoid shipments they consider to be unprofitable resort to the curtailment or abandonment of service by embargoes, rate increases, insistence upon more expensive packaging, and/or by tariff restrictions. The most serious threat to maintenance of adequate small shipments service appears to be the increasing tendency of interlining carriers to cancel through route-joint rate agreements, and their refusal to participate in new agreements (5).

3. The commodity, route, and point restrictions in the operating authorities of regulated carriers restrict their ability to provide that flexibility of service which would benefit small and isolated shippers, in particular.

4. The inability of private carriers to transport non-agricultural commodities imposes a more severe restriction on small shippers than large ones. Small shippers are frequently faced with shipment sizes which are too small, shipment schedules which are too irregular, and shipment destinations which are too scattered to justify private carriage unsupplemented by for-hire transportation.

5. For-hire carriers of agricultural commodities are foreclosed from transporting non-agricultural commodities in backhaul. This is a serious handicap to rural communities whose principal exports are transported by unregulated carriers but whose imports must be effected by regulated or private carriers.

6. Finally, the inefficiency of the existing system is so great that it is difficult to conceive that any internal subsidization in the regulated motor carrier industry that redounds to the benefit of agriculture, rural shippers and receivers could be as great as the regulation-induced rate inflation affecting all users of motor freight transportation.

## A PROPOSED TEST OF REGULATORY IMPLICATIONS

The hypothesis that improvements in technical and pricing efficiency would result from relaxation of regulatory constraints on the motor carrier industry has a compelling theoretical basis. Empirical evidence supports but does not confirm the case for deregulation. We therefore propose a more definitive test. We propose to compare transportation costs, rates and level of service under the existing regulatory environment with expected costs, rates and service under deregulated conditions. We propose a three-pronged course of investigation aimed first at a nation-wide macro examination of regulatory implications; second, at the implications for a specific rural community; and third, at a separation of monopoly profits occasioned by entry barriers from the cost-inflating effects of regulation. The diagram in Figure 1 sets forth the relationship of these three

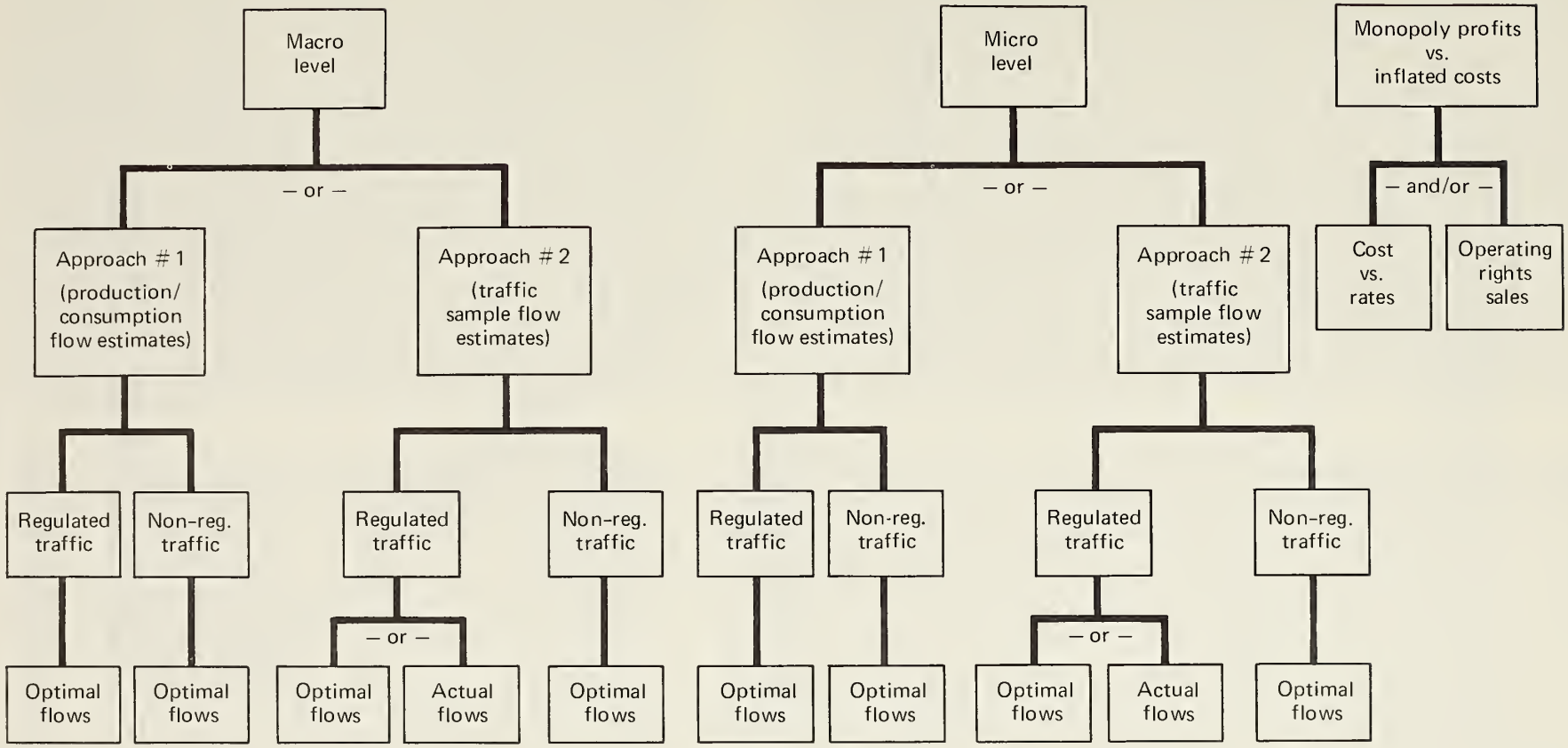



**Figure 1. Alternative analytical approaches for three proposed levels of regulatory investigation—"macro," "micro" and "separation of monopoly profits from cost effects of regulation"**

basic lines of investigation to each other and outlines the alternative approaches or techniques which might be used for each.

While similar analytical techniques are generally appropriate for both macro and micro levels of the study, data needs and sources for each differ appreciably. The analysis of costs and profits will require a separate set of procedures and, depending on specific procedures used, some additional data as well. A transportation model will be used to determine the least-cost routing of unregulated traffic. The objective function of the model will be one of cost minimization. Aggregate costs of resulting traffic flows will be compared with costs of either (1) estimated actual flows under the present regulated system based on a sample of actual shipments or (2) least-cost regulated flows estimated from historical or projected production data and consumption requirements (see Figure 1). If the latter option of least-cost regulated flows is elected, the various regulatory restraints on entry, routing, allowable commodities and frequency of service would be accounted for as constraints in the model. Constraints can be relaxed one at a time to measure the effect of each on system costs.

Figure 2a provides a highly simplified illustration of a hypothetical case where the combined effects of route and entry restrictions under a regulated environment are to raise rates above the level of costs in an otherwise identical free market setting. Assume that 20 tons of a particular commodity are being shipped from node A to node B, while another 20 tons of the commodity are being shipped from A to C by way of B. The total charges for the shipments are: \$1.25 per ton × 20 tons + \$2.50 per ton × 20 tons = \$75.

Higher rates occasioned by regulation in the foregoing example arise partly from entry barriers and partly from route restrictions. Monopoly profits stemming from entry restrictions are assumed to have added \$.25 per ton to the cost of shipment from A to B. A combination of monopoly profits and route restrictions are assumed to have added \$1.00 per ton to the cost of shipment from A to C.

In an unregulated environment in which competition equates rates and costs, the charges for the unregulated shipments are \$1.00 per ton × 20 tons + \$1.50 per ton × 20 tons = \$50 (see Figure 2b). The savings from deregulation are \$25, so that regulation has raised rates by 50 percent.

If monopoly profits on the haul from A to C are the same order of magnitude as those for the A to B movement, then the removal of entry barriers reduces the cost of shipment from A to C by \$.50 per ton. Of the \$25 increase in rates attributable to regulation, \$15 is accounted for by entry restrictions (\$.25 per ton × 20 tons + \$.50 per ton × 20 tons) and \$10 is accounted for by route restrictions (\$.50 per ton × 20 tons).

The effect of backhaul or commodity restrictions could be illustrated by adding one or more additional commodities to the analysis. In fact, the real world is vastly more complicated owing to the multiplicity of commodities and vehicle types, seasonal shipping patterns, rate complexities and other variables. A computerized attack on the problem seems essential if the interactions of even the more important variables are to be understood and measured. A transportation model appears to offer the best hope for an expedient and effective solution.

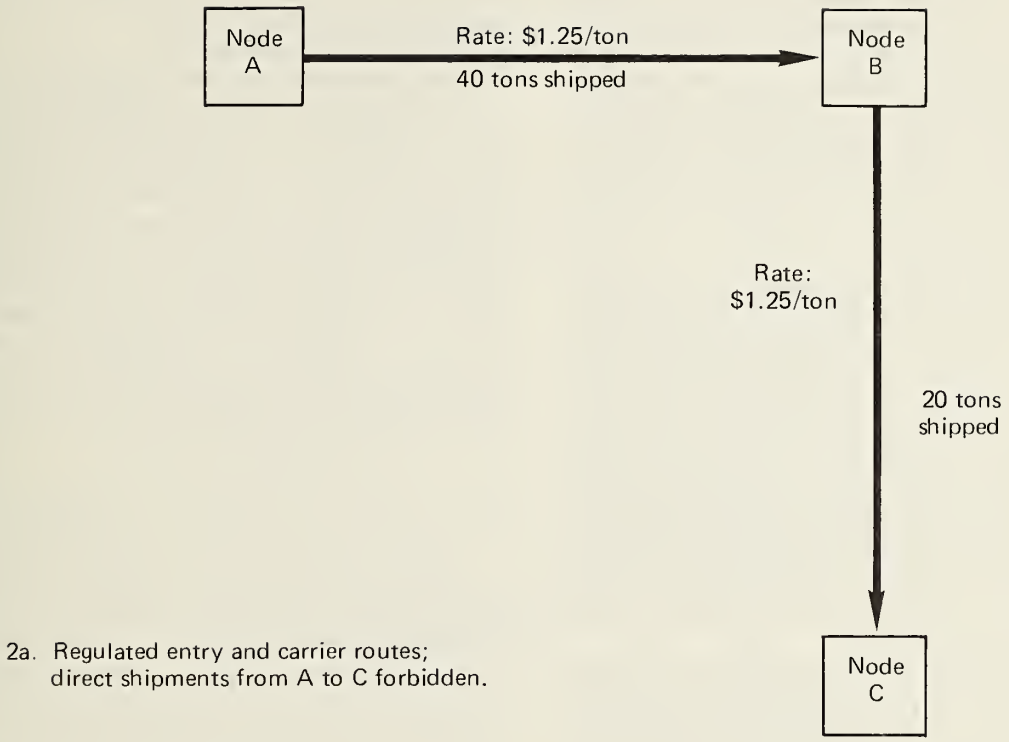
Since cost savings from deregulation are likely to accrue from improved utilization of equipment, viz., higher backhaul ratios, more efficient routing of traffic and consolidation of loads, there is no need to consider traffic in goods requiring highly specialized equipment. There appears to be limited opportunity, for example, for improving technical efficiency in the transfer of liquid petroleum products through deregulation since little else can be hauled in a petroleum truck.[3] It is, however, important to account for the shipment of goods commonly carried in specialized equipment where shipment in less specialized equipment might be feasible. In such cases specialization may have been induced by regulatory constraints rather than by more basic economic factors. It is essential to include private and exempt, as well as contract and common, carrier shipments in the analysis since private carriage may at times be fostered by regulatory restraints and since, in the absence of regulation, exempt commodities might at times be carried along with other items in the same load or as return hauls in the same truck.

## The Macro Model

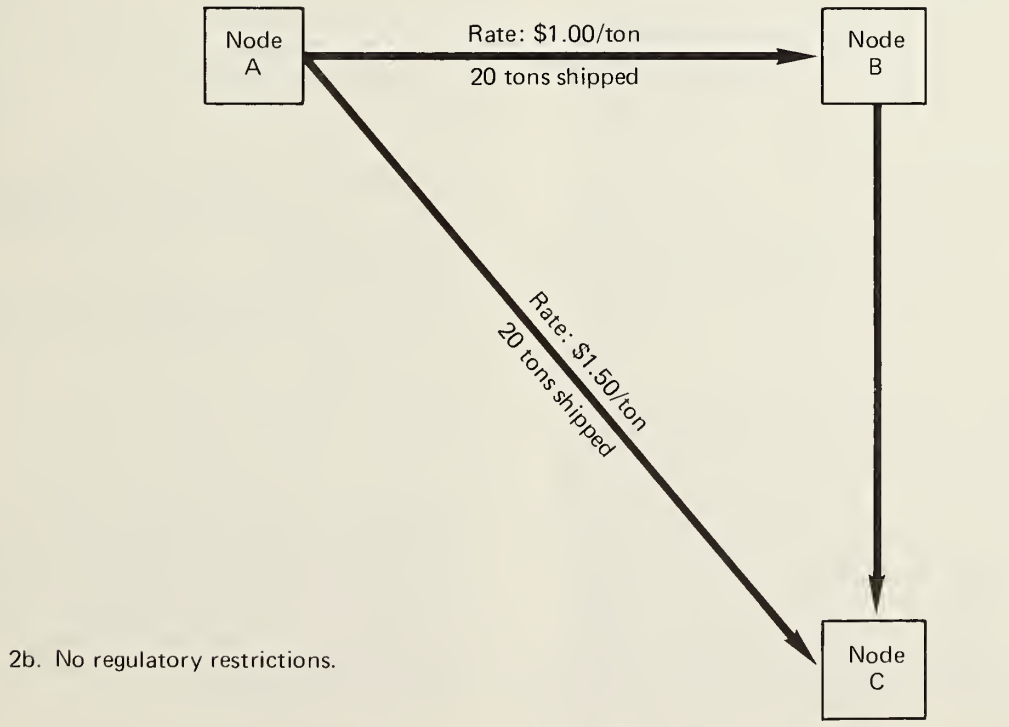
The major task under either alternative (traffic flow samples or flows estimated from production and consumption data) is estimating traffic at all nodes in the transportation network. For the macro investigation we hope to model the major patterns of truck shipments, by commodity type, for the continental United States. If approach number 1 is taken the 48 contiguous states would probably become the nodes since major census series provide state data on production and consumption patterns. Census of Agriculture production patterns would be supplemented with ERS-USDA estimates of commodity marketings to provide modal supply estimates for raw agricultural products. Census of Manufactures' data would form the basis for estimating state supplies of manufactured products.

Consumption requirements at each node (state) would be estimated based on population, disposable income, climate, or other indicators of effective aggregate demand. Heavy reliance would be placed on secondary sources, primarily censuses of population, retail trade and possibly housing.

Approach number 2 would be built primarily on Census of Transportation data (Commodity Transportation Survey). Actual traffic flows (tons and ton-miles), by commodity type, specific mode, origin




2a. Regulated entry and carrier routes; direct shipments from A to C forbidden.




2b. No regulatory restrictions.

**Figure 2. Hypothetical example of internodal traffic and shipper costs, for a single commodity, under regulated and unregulated conditions**

and destination, are needed to model the existing regulated system. The Census of Transportation flow data permit identification of specific commodity types, mode of shipment, tonnage and ton-mileage by product type, but geographical coverage is not comprehensive. The census data were gathered from 27 "production areas" (SMSA's) and 59 "destination areas" (the 27 SMSA's plus 23 "market areas" consisting of selected states surrounding or adjacent to the production areas). Nor can both origin and destination be identified for any particular commodity or modal break-down.

An advantage of approach number 1 is the more conservative nature of any estimated cost savings from deregulation. All traffic flows under the regulated system would be optimized subject only to regulatory constraints. Furthermore, actual traffic flows would not need to be measured; hypothetical flows could be developed based on estimated quantities available at production nodes and quantities required at consumption nodes. The major disadvantage is the need for detailed estimates of quantities produced and consumed at the nodes under consideration. Further difficulties encountered in separating the cost and profit effects of regulation will be noted in a later section.

Approach number 2 avoids potential problems in inferring traffic flows from geographic patterns of production and presumed patterns of consumption. Although the analysis would be based on actual (regulated) product flows, the pattern of shipments of known origin and destination volumes could be optimized before comparing them with estimated unregulated flows. The major disadvantage of this approach is the incomplete geographic coverage of the available data on actual traffic flows. Since the Census of Transportation covers only manufactured products and only shipments from major manufacturing centers, shipments of agricultural and mining products would have to be inferred from estimated production and consumption patterns as in alternative 2.

Both approaches require knowledge of trucking rate structures as well as detailed estimates of trucking costs. Differences by commodity, truck type and geographic area must be accounted for. Published rates for regulated hauls must be supplemented with estimated costs for exempt and private shipments.

Trucking costs can be synthesized using economic-engineering procedures. Account must be taken of the effect on costs of truck size and type, commodity, length of haul and geographic area. Results from previous studies will provide a starting point, but much of the data will have to come from primary sources.

## The Micro Model

While the macro approach outlined previously should provide estimates of the aggregate costs of motor carrier regulation, a narrower focus is needed if the incidence of the social costs of regulation is to be estimated. Since our primary interest is in implications of deregulation for rural areas, we propose to undertake a case study of costs, rates and services before and after deregulation.

The transportation model employed in the aggregate study will be adapted for application to a small rural community or adjacent group of communities. Major traffic flows to and from (and within if such flows prove to be of consequence) the area will be identified. Personal iterviews, perhaps supplemented by mail questionnaires, will be employed to measure traffic to and from major receivers and shippers of goods which can be hauled in non-specialized vehicles. Freight rates and economic-engineering estimates of trucking costs will be applied, as in the macro model, to actual and optimized traffic flows.

## Separating Cost Effects from Monopoly Profits

If actual rates charged by regulated carriers are, as hypothesized, higher than costs for an unregulated system, the difference may represent technical inefficiency, pricing inefficiency or some combination of both. If the costs are for an optimized unregulated system the difference may include a measure of "X" inefficiency as well (see Figure 3). The former two effects can be separated by the following process: First, total rates charged for regulated shipments can be compared with estimated actual total costs for the same regulated shipments. Subtracting total costs (defined to include an implicit return to capital) from total revenue gives total monopoly profits. Second, subtracting total costs of optimum unregulated traffic flows from total carrier costs of optimum regulated flows will provide an estimate of the total cost effects of regulation.

Alternatively, monopoly profits can be estimated more directly by analyzing sample sales of carriers' operating rights. Presumably these rights would have no value if the regulated firms were in a purely competitive market. The sales price of a certificate or permit must represent the estimated capitalized value of a future stream of monopoly profits. The annual value of the operating rights (total annual pure profit) would then be equal to the sales value of the operating authority multiplied by the discount rate. The ratio of the resulting annual profits to the annual operating revenues received in conjunction with ownership or use of the operating authority can be applied against industry revenues to estimate industry monopoly profits.

## FOOTNOTES

[1]Economic-engineering estimates of the cost of transporting livestock, grain, and wheat by firms of different sizes can be found in (2, 14, and 1).

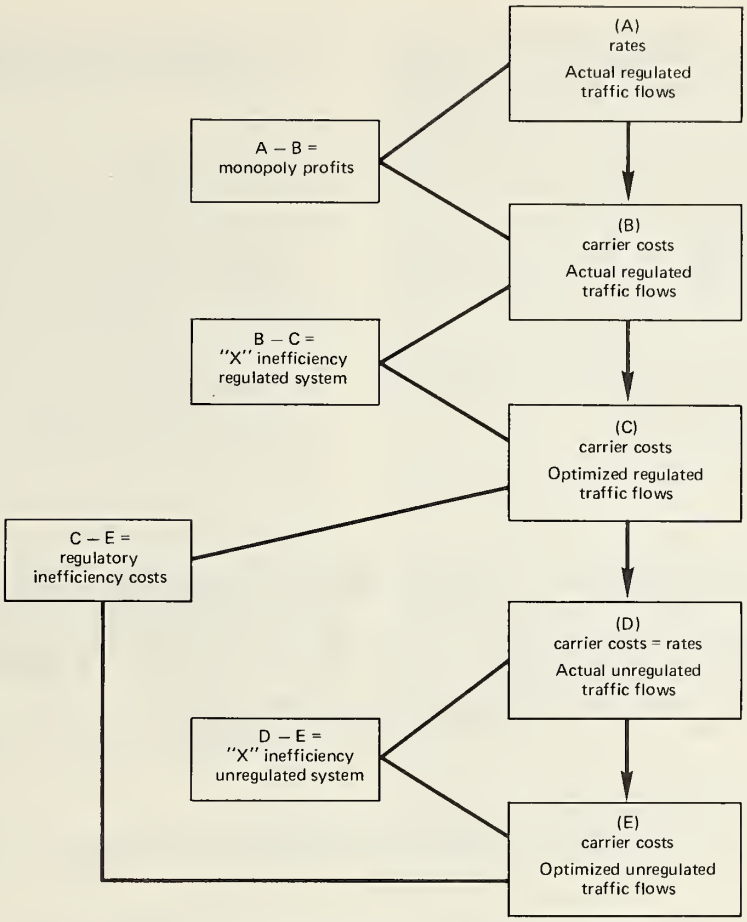



**Figure 3. Expected rate and carrier cost relationships under regulated and unregulated conditions, actual and optimized traffic flows**

[2]This summary of the British experience with regulation and deregulation is drawn from (11, pp. 7–39).

[3]Although route and point restrictions may apply to specialized vehicles and though competition may affect load size and frequency of service, no attempt will be made to measure elevation in social costs from these sources. Our estimates will therefore tend to understate the probable costs of regulation.

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# An Assessment of the Economic Performance of Motor Carriers of Exempt Agricultural Commodities[1]

James C. Cornelius
Assistant Professor of Agricultural Economics
Montana State University

The debate surrounding the efficacy of economic regulation in interstate truck transportation calls frequently upon the alleged positive or negative economic performance of exempt, or unregulated truck transportation. Used analogous to the "control" case of a scientific experiment, the performance of exempt motor carriers is thought by some to exemplify that of the motor carrier industry in the absence of governmental economic regulation.

There has been economic research conducted in the area of exempt motor carriage, dealing primarily with the case involving motor carriers of exempt agricultural commodities (6, 13, 11, and 1).

In large, this research has indicated that the performance of exempt agricultural truckers results in a reasonably efficient, competitive market, having largely avoided ruinous "excessive" competition. It should be noted, however, that these conclusions are not universally accepted in all transportation circles.

Two problem areas which appear to be common to much of the previous agricultural exempt transportation research are: (1) the size and scope of the sample population of carriers upon which conclusions are drawn; and, (2) the scope of the inquiry with regard to the agricultural exemption itself. The former problem is almost a universal issue in all empirical research and one whose roots can be traced to exogenous restraints upon research funding and time. The latter problem is, for this reason, probably more critical, for it more directly influences the direction and scope of the research inquiry itself, rather than the nature of the supporting data. Specifically, an evaluation of the performance of motor carriers of exempt agricultural products must also be concerned with the design or intent of the exemption itself, for it is the intent of the exemption which serves as the basis for an expected performance. In this sense, it may be that too much of the economic research concerning agricultural exempt trucking has been focused at the performance of exempt trucking, and not enough at the performance of the exempting legislation itself. That is, the intent of the exemption provides a basis for establishing the anticipated performance of agricultural truckers. The overall objective of the research reported here was to evaluate the efficacy of the agricultural exemption as manifested in the performance of motor carriers of exempt agricultural commodities (MCEAC).

In order to provide a sufficiently broad data base, a national survey of agricultural truckers was performed based on a mailing list developed from the records of twenty-two individual states which maintained address files on exempt carriers operating in their respective states.[2] Ultimately, 8,982 usable questionnaires were returned in which truckers identified themselves as MCEAC. Based on the response rate to the national survey (three mailings), the 8,982 usable questionnaires represented a net

response rate of 41.4% of an estimated total MCEAC population in 1974 of 21,710 (see 12 for discussion of estimating procedure).

## THE CONCEPTUAL MODEL

The approach selected for analyzing performance in this study is one of comparison and/or evaluation. Conceptually, the exemption desires are combined with the theoretical market and industry characteristics of motor carriers of exempt agricultural commodities (MCEAC) to develop a set of anticipated dimensions of performance (ADP). These ADP are then compared to actual MCEAC performance indicators as determined by the national MCEAC survey results and supporting secondary information. The correspondence or deviation between the actual and anticipated performance of MCEAC serves as the basis of the evaluation. This format is illustrated in Figure 1.

### Anticipated Dimensions of Performance: The Evaluatory Model

Reiterating the above, the ADP draw together the original and continuing intent of the agricultural commodity exemption as given in Section 203(b) subsection 6 of the Interstate Commerce Act, and the performance expectations that follow theoretically from the known structure and conduct of the MCEAC industry. The salient features of these two paradigms may be briefly summarized as follows.

*The intent of the agricultural exemption.*—The agricultural exemption was designed primarily to insure the provision of transportation services demanded by agriculture. Four basic, although interrelated, service features can be identified in this respect. Foremost among these is a flexibility on the part of carriers to serve the diverse geographical, seasonal, and commodity-specific transportation needs of agricultural shippers. Associated with this is the desire for a high degree of stability or reliability on the part of carriers in providing the needed service. Thirdly, agricultural transportation must be strongly responsive to shipper demand, unencumbered by burdensome regulatory restraints. Lastly, the exemption was expected to create a competitive, atomistic agricultural trucking sector to insure the lowest competitive market rates for agricultural shippers.

Explicitly, these desires point to an exemption designed to aid the agricultural producer. The flexibility, stability, responsiveness and low rates were

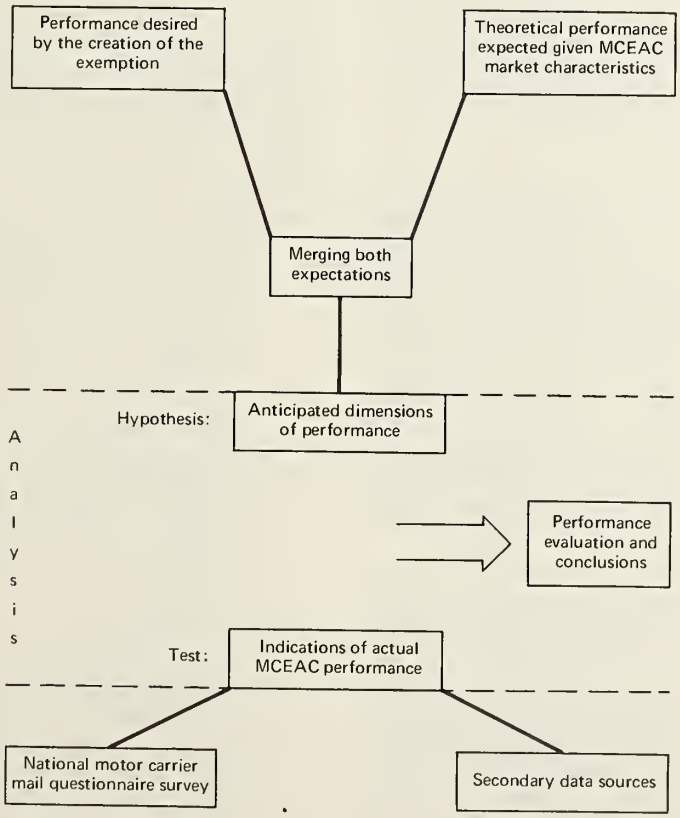


**Figure 1. Conceptual model for analysis of performance of the agricultural exemption**

evidently thought to be most likely provided by a competitive transportation market. In addition, an argument may be advanced that the agricultural exemption was concerned not only with the transportation service provided by the exemption, but also in the efficiency of such provision. That is, the MCEAC must be able to provide the desired agricultural transportation at least as efficiently as any alternative method, to meet the primary goal of benefiting agricultural producers. It seems unlikely that the agricultural exemption could exist as a free market sanction if more efficient methods of providing this service were available.

*Structural characteristics and theoretical expectations of the MCEAC industry*.—Existing literature has provided data on several fundamental structural aspects of the MCEAC industry (4, 15, 7, and 16). These recognized features can be summarized briefly as follows:

(1) MCEAC are typically small operations, single entrepreneurs with a few trucks and perhaps hired drivers. Significant economies of firm size do not seem to exist. To the extent agricultural shippers are also small operations, the resulting market is fairly atomistic. The price-making potential of single MCEAC firms can be expected, therefore, to be very limited.

(2) Market information is accessible to both shippers and carriers through various means such as a network of truck brokerage firms. A "grapevine" information system also exists which incorporates the seasonability, peak demand periods, and product flows in agricultural transportation.

(3) Perhaps the most conspicuous feature of the MCEAC sector, as contrasted with the regulated sector, is the ease of entry into the agricultural exempt market. The fixed investment associated with securing a truck is the primary barrier to entry of new firms. The rates of firm entry and exit should rapidly adjust so as to provide a reasonable measure of industry profitability. If excess demand exists in a specific market situation which cannot be met with the supply of trucks in business, new MCEAC will enter the market. Similarly, if excess capacity, or an over supply of MCEAC exists, firms unable to cover long run costs should ultimately fail and exit the market.

(4) Truck transportation is seemingly a very homogenous product, however, the use of commodity-specialized equipment in some markets imposes restrictions on the substitutability of the exempt transportation service. In this respect, exempt agricultural truck transportation is perhaps a more segmented industry than it has been portrayed. Within commodity submarkets, however, MCEAC service is more nearly homogenous. This precludes market discrimination, particularly in view of the ease of entry into the MCEAC industry. There are factors, such as location and reputation for reliability, that differentiate carriers, and possibly their appeal, to particular shippers.

### Anticipated Dimensions of Performance

It would be difficult to develop anticipated dimensions of performance (ADP) which combined legislative, historical and theoretical facets, if major conflicts existed among these considerations. Such is not the case, however. The evidence presented above demonstrates that the intent of the exemption is reasonably compatible with the theoretical expectations; both rely heavily upon the performance attributes of a competitive MCEAC industry.

Four ADP have been selected specific to the MCEAC industry which best combine the theoretical and desired performance of MCEAC. These are: (1) responsiveness to demand; (2) stability; (3) profitability; and (4) capacity utilization. With only a few qualified exceptions which will be noted, the anticipated performance parallels the expectations of the perfectly competitive economic model. This is convenient in that a fairly patent set of theory is available regarding performance for this model.

## METHODOLOGY

The basis for evaluating the actual MCEAC performance, as derived from the MCEAC survey, consists of testing for the predicted associations as given in the ADP. For this purpose, ten measures of actual MCEAC performance were drawn from the survey. As listed below, these measures are taken directly from the survey as a tabulation of responses to single or combined questions:

1. Type MCEAC—identity in terms of operating rights possessed by carrier;
2. Commodity hauled—ten catagories including one for nonexempt goods, by percent hauled inbound and outbound;
3. Size of firm—in terms of number and types of equipment, both currently and in year firm was established;
4. Total mileage—by firm during 1973;
5. Empty mileage—as a percent ot total mileage;
6. Length of haul—five trip length intervals with percent of firm mileage in each for empty and total miles;
7. Years in business—from year business started or purchased to 1974;
8. Leasing practices—percent equipment leased and/or leased out during 1973;
9. Regional patterns—most common trip loaded and empty, and state of domicile;
10. Utilization attitude—amount firm believed it could reduce empty mileage in the absence of specified regulatory restraints.

In addition to the performance information con-

tained in the survey, reinforcing data from ICC, USDA, and elsewhere were also used in order to strengthen the analysis. Two additional performance indicators were established based on these sources, adapted as necessary to the survey data:

11. Agricultural marketings—by year, by commodity, as a proxy for transportation demand;
12. Mortality—estimated exit rates of MCEAC.

The twelve basic performance measures were applied to the individual ADP. The resulting model is shown in Figure 2. The desired performance relationships are presented through cross tabulations and statistical testing of specific performance variables. There exists no patent rule in selecting either the number or type of performance indicators used to evaluate a specific ADP. A single measure has various implications in context. Thus, the design or combination of evaluatory measures must be tailored for each ADP in accordance with the hypothesis tested. In each case, the individual tests have been stated in terms of the null hypothesis; that performance which is contrary to the ADP. This type of test should be easier to judge than the direct hypothesis suggested by the ADP. That is, given the often delphic nature of performance measures, identifying dissimilarities between actual and anticipated performance may be easier, yet provide the same information as attempting to prove correspondence between the two.

## RESULTS

### Operating Characteristics

Two basic MCEAC operating characteristics explicitly a part of the performance measures—type carrier and commodity hauled—are introduced at this point in order to facilitate reference to observed relationships in the ensuing evaluations. These two operating characteristics represent the results of the MCEAC survey only; no attempt is made either here or in the individual ADP evaluations except as noted to extrapolate statistics from the MCEAC sample to the MCEAC population.

*Distribution of MCEAC by type.*—Type of carrier, with regard to operating authority, is a very important distinction among MCEAC. The agricultural exemption is a commodity, rather than a carrier exemption. As a result, there is an interrelationship between regulated and solely exempt MCEAC for

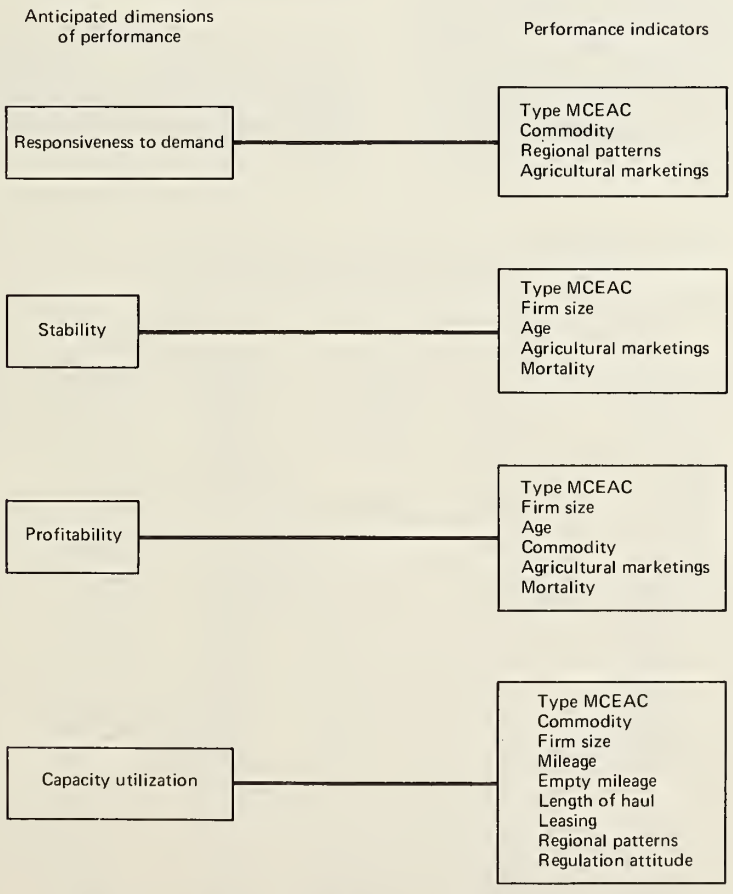


**Figure 2. Performance indicators used in evaluating the anticipated dimensions of performance**

the purpose of agricultural exempt carriage. Four specific types of MCEAC are identified in this report:

AGEX—motor carriers operating solely under the agricultural exemption with no ICC or intrastate regulation;

ICC—motor carriers of exempt agricultural commodities also holding ICC operating rights;

INTRA—motor carriers of exempt agricultural commodities also operating as regulated intrastate carriers;

BOTH—motor carriers of exempt agricultural commodities also holding ICC operating rights and operating as regulated intrastate carriers.

The distribution of MCEAC by type of operating authority is shown in Table 1. AGEX carriers comprise the largest single grouping with nearly as many carriers as the three regulated types combined.

*Distribution of MCEAC by commodity hauled.*—Carriers in the survey responded to the question regarding commodity(s) hauled in terms of a percentage of total yearly tonnage hauled on both outbound and homebound trips across state lines. In order to distinguish between commodities hauled only casually or infrequently, as opposed to commonly hauled goods, a criterion of greater than 30 percent total interstate tonnage of a specific commodity or commodity groups was selected to separate major and minor commodities hauled.[3] This 30 percent figure is not entirely arbitrary, but reflects a fairly observable break in the overall distribution of responses. Further, it captures bi- or tri-commodity specialization among haulers that was to be anticipated in view of MCEAC flexibility. The distribution of carriers by major commodity hauled by type is given in Table 2.

Table 1. Number of sampled MCEAC by type of Operating Authority, 1974

| Type carrier | Number of firms | Percent of total |
|---|---|---|
| AGEX | 3,185 | 48.4 |
| ICC | 868 | 13.2 |
| INTRA | 1,377 | 20.9 |
| BOTH | 1,152 | 17.5 |
| TOTAL | 6,582 | 100.0 |

In addition to these two characteristics, the MCEAC survey supplied information on numerous other facets of MCEAC operation. Generally, these characteristics will become evident as by-products of the ADP evaluations which are now presented.

## Responsiveness to Demand

The performance anticipated regarding responsiveness by MCEAC to the demands of agricultural shippers comes directly from the desires of the original exempting motor carrier legislation. That is, MCEAC enjoy the flexibility, readily available mar-

Table 2. Distribution of sampled carriers by major commodity hauled, direction of loaded tonnage movement, and type of carrier, 1973

| Major Commodity | AGEX | | ICC | | INTRA | | BOTH | |
|---|---|---|---|---|---|---|---|---|
| | Outbound (%) | Homebound (%) | Outbound (%) | Homebound (%) | Outbound (%) | Homebound (%) | Outbound (%) | Homebound (%) |
| Fruits and vegetables | 30.4 | 39.2 | 20.7 | 33.1 | 14.7 | 20.8 | 8.0 | 16.6 |
| Poultry and eggs | 7.8 | 1.7 | 4.8 | 1.5 | 3.9 | 1.6 | 2.8 | 2.6 |
| Grain | 25.5 | 15.9 | 28.3 | 17.3 | 30.8 | 20.8 | 27.1 | 17.3 |
| Livestock | 13.8 | 9.4 | 16.5 | 10.2 | 30.6 | 25.6 | 29.0 | 19.3 |
| Cotton and wool | 1.4 | 0.7 | 1.0 | 0.0 | 1.2 | 0.5 | 1.2 | 0.9 |
| Hay and forage | 0.9 | 1.6 | 1.5 | 1.3 | 1.6 | 3.0 | 1.2 | 1.7 |
| Dairy | 1.3 | 1.0 | 1.2 | 1.3 | 2.4 | 2.4 | 3.5 | 1.1 |
| Other exempt commodities | 8.6 | 10.6 | 8.8 | 12.6 | 8.2 | 10.8 | 6.5 | 9.6 |
| Nonexempt commodities | 11.1 | 19.9 | 17.4 | 22.8 | 6.5 | 14.3 | 20.6 | 30.4 |

NOTE: Columns may not sum to 100 percent due to rounding error.

ket information, and resource mobility which provides for ready responsiveness to shipper demands in terms of both the basic transportation services as well as accompanying service features.

Two different approaches were used to judge responsiveness to demand: (1) regional service coverage; and (2) MCEAC entry rates by commodity over time.

Regional truck supply patterns as reported in the MCEAC survey show a high correlation between regional agricultural product marketings and carrier domicile. In fact, this correlation is nearly a one-to-one correspondence, as illustrated in Figure 3. This implies that, on a national level, MCEAC appear to domicile in areas in direct proportion to the intensity and/or availability of agricultural production.

While the domicile statistics suggest responsiveness to demand, a more meaningful causal relationship can be observed by regressing firm entry rates over time against corresponding agricultural commodity marketings, where entry is identified by major commodity hauled. In that firm entry represents the addition to total number of MCEAC for a given year ($\Delta T_t$), it is appropriate to also consider the yearly changes or first differences in the volume of commodity marketings ($\Delta Q_t$). This relationship may be expressed as:

$$\Delta T_t = (\Delta Q_t). \tag{1}$$

The observed entry rate captures only surviving MCEAC; it does not reflect the total number of MCEAC that entered the industry in a given year. The exit, or mortality rate of firms by year is an unknown quantity. It must be assumed, therefore, that the observed number of carriers entering in year $t$ and surviving to 1974 ($S^{74}\Delta T_t$) is biased downward at some rate as a function of age ($A_t$). This can be expressed as:

$$S^{74}\Delta T_t = g(\Delta T_t, A_t). \tag{2}$$

Linear approximation of these two relationships, substituting for $\Delta T$ and simplifying, allow for a single equation linear approximation of the form:

$$S^{74}\Delta T_t = k_0 + k_1 \Delta Q_t + k_2 A_t. \tag{3}$$

Alternatively, a one year lagged first difference in marketing volume can be expressed as:

$$S^{74}\Delta T_t = k_0 + k_1 \Delta Q_{t-1} + k_2 A_t. \tag{4}$$

Responsiveness to demand on the part of MCEAC should appear as a positive coefficient on $k_1$, in that both total entry of MCEAC and the change in volume in commodity marketings in a given year are intuitively directly related to the observed entry rate of surviving firms.

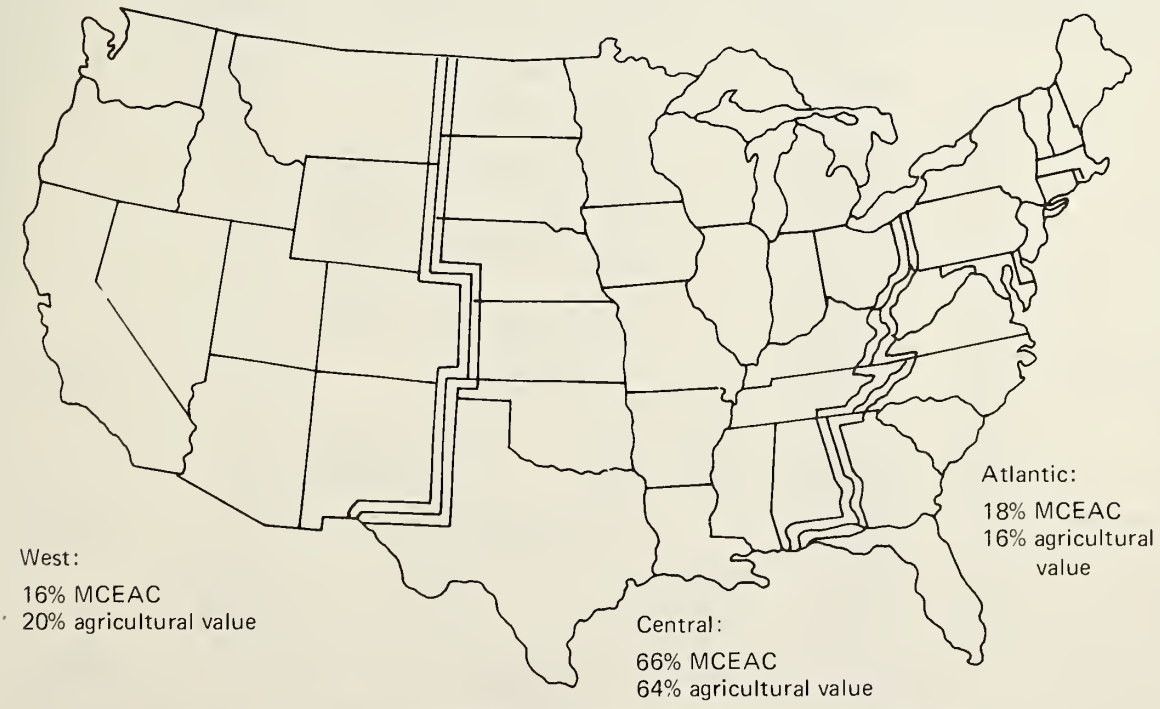


**Figure 3. Regional patterns of MCEAC domicile and values of farm marketings, 1974**

The age variable in equations (3) and (4) separates the influence of trends associated with the mortality rate from changes in the volume of commodity marketings. In addition to the linear form shown above, the age variable can be altered to account for varying rates of mortality over time. Two nonlinear forms of age which can be conveniently substituted in the above relationship to produce successively greater curvature are the log of age and the inverse of age.

The regression results by commodity groupings using ordinary least squares are shown in Table 3. For each grouping, six regressions were run; first differences with each of the three different expressions of age, and lagged first differences with each of the three expressions of age. This allowed for a tailoring of response patterns to individual commodity markets. The formulation which provided the most significant positive coefficient on commodity marketings was chosen as the appropriate form, and is so indicated in Table 3. With the exception of dairy and non-exempt commodities, MCEAC responsiveness appears to follow a yearly lag, indicating that carriers enter the market in response to the previous year's demand. Alternatively, this may suggest that marketings of these commodities occur in the period following the harvest or initial marketing period.

In general, the correlation between number of firms entering by year and corresponding measures of commodity marketing volume supports the responsiveness to demand ADP. Although significance of the marketing volume variable is often weak, the sign of the coefficient is in all cases positive, indicating a direct relationship between MCEAC entry and shipper demand.

## Stability

The economic stability of MCEAC is the focal point for a long-standing criticism of exempt trucking. Opponents of unregulated carriage maintain that unrestricted entry into the trucking industry leads to over capacity, which, in turn, leads to pricing below

Table 3. Estimated responsiveness to demand equations

| Commodity Hauled | Variable | | | | | | |
|---|---|---|---|---|---|---|---|
| | Intercept | First difference in yearly marketing volume | Lagged first difference in yearly marketing volume | Age | Log age | 1/Age | $R^2$ |
| Fruits and vegetables | 227.325<br>(23.249) | | 0.029<br>(1.687) | | -77.030<br>(14.275) | | .96 |
| Poultry and eggs | 27.681<br>(8.973) | | 0.414<br>(0.835) | | - 8.897<br>(5.451) | | .76 |
| Grain | 199.207<br>(9.161) | | 0.026<br>(1.718) | -15.982<br>(5.731) | | | .84 |
| Livestock | 79.547<br>(14.354) | | 2.011<br>(3.124) | - 4.996<br>(6.700) | | | .86 |
| Cotton and wool | 8.942<br>(6.923) | | 0.011<br>(0.534) | - 0.695<br>(3.932) | | | .66 |
| Hay and Forage | 1.485<br>(1.479) | | 0.349<br>(1.306) | | | 14.482<br>(5.643) | .78 |
| Dairy | 10.130<br>(5.843) | 0.954<br>(2.217) | | - 0.679<br>(3.132) | | | .53 |
| Other exempt | 20.736<br>(4.003) | | 9.810<br>(0.958) | | | 63.652<br>(4.638) | .71 |
| Nonexempt | 134.483<br>(16.127) | 1.273<br>(1.321) | | | -41.505<br>(9.753) | | .91 |
| Total MCEAC | 162.564<br>(4.504) | | 7.056<br>(0.989) | | | 699.971<br>(7.321) | .85 |

NOTE: |t| values of the coefficients are given in parentheses.

short run variable costs on the part of carriers in order to secure business. As a consequence, the industry is seen as being in a continual state of instability due to a chronic redundancy of capacity relative to demand.

The anticipated dimension of performance does not support this contention. There is little to support the paradoxical situation implied by the instability thesis whereby an industry characterized by freedom of entry and exit will continually over invest in capital resources. Under the anticipated performance, MCEAC are responsive to market signals influencing entry and exit. Changing transportation demand situations and MCEAC resource mobility will cause continual changes in the industry population. The entry and exit of carriers associated with these conditions, however, is a symptom of a demand-responsive service industry, and not necessarily inherent economic instability.

The evaluation of stability considered two aspects of MCEAC performance: (1) the entry rate of firms; and (2) the exit of firms from the industry. This information should reflect the turn-over rates of MCEAC, thus, tracing the relative stability of carriers over time.

*Entry*.—Entry rates of MCEAC responding to the survey are reported in Table 4. Again, this data reflects the entry rate of surviving firms only, in that some proportion of the total firms entering in year *t* have subsequently left the industry prior to the time of the survey.

Based on the latest complete year, 1973, MCEAC entry appears to be approximately 10 percent of the total population per year. Regulated and unregulated MCEAC are listed separately in Table 4 in that entry would intuitively be more difficult for regulated carriers, which is borne out in the figures reported. Although Table 4 overlooks institutional relationships affecting entry and age, a general conclusion can be made that MCEAC firms do not all summarily fail in their first years of existence due to the alleged destructive competition and over capacity. In fact, roughly 52 percent of the regulated MCEAC and 43 percent of the unregulated MCEAC are 20 years of age or older. Given the free market situation in exempt motor carriage, it seems doubtful that this many firms could survive to the present under conditions of destructive competition.

*Exit*.—Survival data, coupled with exit data,

Table 4. Distribution of sampled MCEAC by year started

| Year started | Type of carrier | | | | | |
|---|---|---|---|---|---|---|
| | Regulated[a] | | Unregulated[b] | | Total | |
| | Number | Percent[c] | Number | Percent[c] | Number | Percent[c] |
| 1973 | 343 | 8.8 | 432 | 11.8 | 775 | 10.3 |
| 1972 | 287 | 7.4 | 318 | 8.7 | 605 | 8.0 |
| 1971 | 235 | 6.1 | 265 | 7.3 | 500 | 6.6 |
| 1970 | 211 | 5.4 | 274 | 7.5 | 485 | 6.4 |
| 1969 | 186 | 4.8 | 196 | 5.4 | 382 | 5.1 |
| 1968 | 153 | 3.9 | 180 | 4.9 | 333 | 4.4 |
| 1967 | 126 | 3.2 | 102 | 2.8 | 228 | 3.0 |
| 1966 | 119 | 3.1 | 98 | 2.7 | 217 | 2.9 |
| 1965 | 113 | 2.9 | 104 | 2.9 | 217 | 2.9 |
| 1964 | 99 | 2.6 | 104 | 2.9 | 203 | 2.7 |
| 1963 | 67 | 1.7 | 73 | 2.0 | 140 | 1.9 |
| 1962 | 78 | 2.0 | 85 | 2.3 | 163 | 2.2 |
| 1961 | 89 | 2.3 | 69 | 1.9 | 158 | 2.1 |
| 1960 | 115 | 3.0 | 113 | 3.1 | 228 | 3.0 |
| 1955-1959 | 364 | 9.4 | 290 | 8.0 | 654 | 8.7 |
| 1950-1954 | 312 | 8.0 | 233 | 6.4 | 545 | 7.2 |
| 1945-1949 | 374 | 9.6 | 258 | 7.1 | 632 | 8.4 |
| 1940-1944 | 133 | 3.4 | 79 | 2.2 | 212 | 2.8 |
| 1935-1939 | 116 | 3.0 | 90 | 2.5 | 206 | 2.7 |
| 1930-1934 | 97 | 2.5 | 66 | 1.8 | 163 | 2.2 |
| 1929 and earlier | 262 | 6.8 | 218 | 6.0 | 480 | 6.4 |

[a]ICC, INTRA and BOTH.
[b]AGEX.
[c]As a percent of type carrier population. Column totals may not equal 100 percent due to rounding error.

would ideally provide an accurate mortality profile of the MCEAC industry over time. Unfortunately, empirical data regarding the identity of, year in which, and conditions under which MCEAC firms left the industry were not available from the MCEAC survey. However, by utilizing the data available from a 1960 survey of agricultural motor carriers (4), in addition to the 1974 MCEAC survey, demographics from two different points in time can be established. This provides a basis for inferences about the exit rate of MCEAC. Miklius and Casavant have employed such an approach to estimate a cumulative business mortality function which describes the relationship between age of firms and the conditional probability of exit from the MCEAC industry.[4]

The Miklius and Casavant cumulative mortality function (CMF) is based on a hyperbola suggested by (9) of the form:

$$(5) \quad f(t) = 1 - \left(\frac{a}{a+t}\right)^b$$

where $a$ and $b$ are parameters and $t$ is age of the firm. Given the implicit assumption that mortality of firms is a function of age only, the parameters of the CMF can be established as follows using the demographics of the two surveys at two different points in time.

Using the observed entry rates reported in the respective surveys, the parameters $a$ and $b$ were estimated by a method of non-linear least squares.

The next step in the Miklius and Casavant stability analysis was to compare the mortality of MCEAC with that of other unregulated industries. If entry and exit rates of MCEAC are indeed higher, reflecting instability in the industry, the estimated CMF should lie above the CMF of firms in other unregulated industries. Although there are no contemporary sources for data on business mortality, two earlier sets of data were available for comparisons. The first set was based on the experience of business enterprises, with the exception of financial establishments and public utilities, in the city of Poughkeepsie, New York, during the 82 year period from 1844 to 1926 (8). The second set of mortality data consisted of the Office of Business Economics (OBE) estimates of business life expectancy in the United States based on the 8 year period from 1947 to 1954 (2).

For both the Poughkeepsie and OBE data, separate CMF were estimated for manufacturing, retail trade, and service industries. The same functional form shown in equation (5) was used in all cases. Figures 4 and 5 illustrate the comparison of the CMF for MCEAC and the three industry groupings, for the Poughkeepsie and OBE estimates, respectively. Interpreting these relationships, MCEAC enjoy a much greater probability of survival up to 25 years of age, thereafter generally approximating the mortality rate in the three comparative industries.

The Miklius and Casavant estimate of the MCEAC CMF does not produce a particularly good fit on the observed 1974 MCEAC data. In fact, the

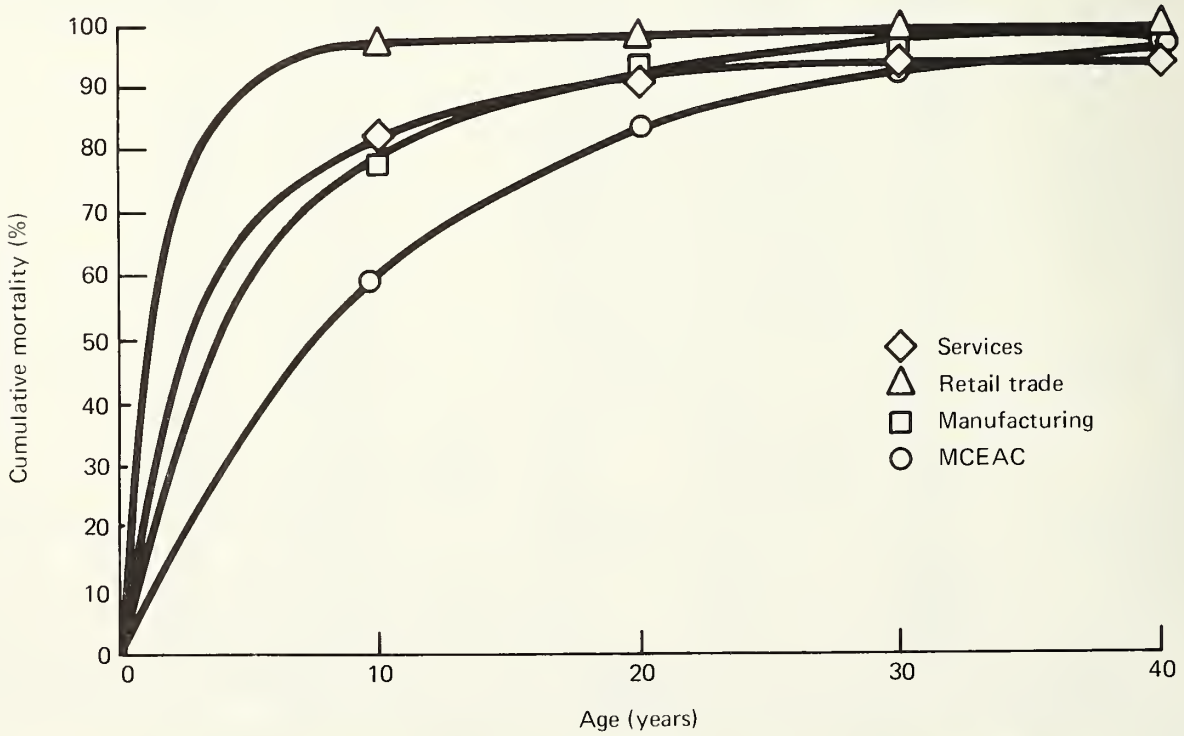


**Figure 4. Cumulative mortality, Poughkeepsie data and MCEAC. Adapted from: Miklius and Casavant (12)**

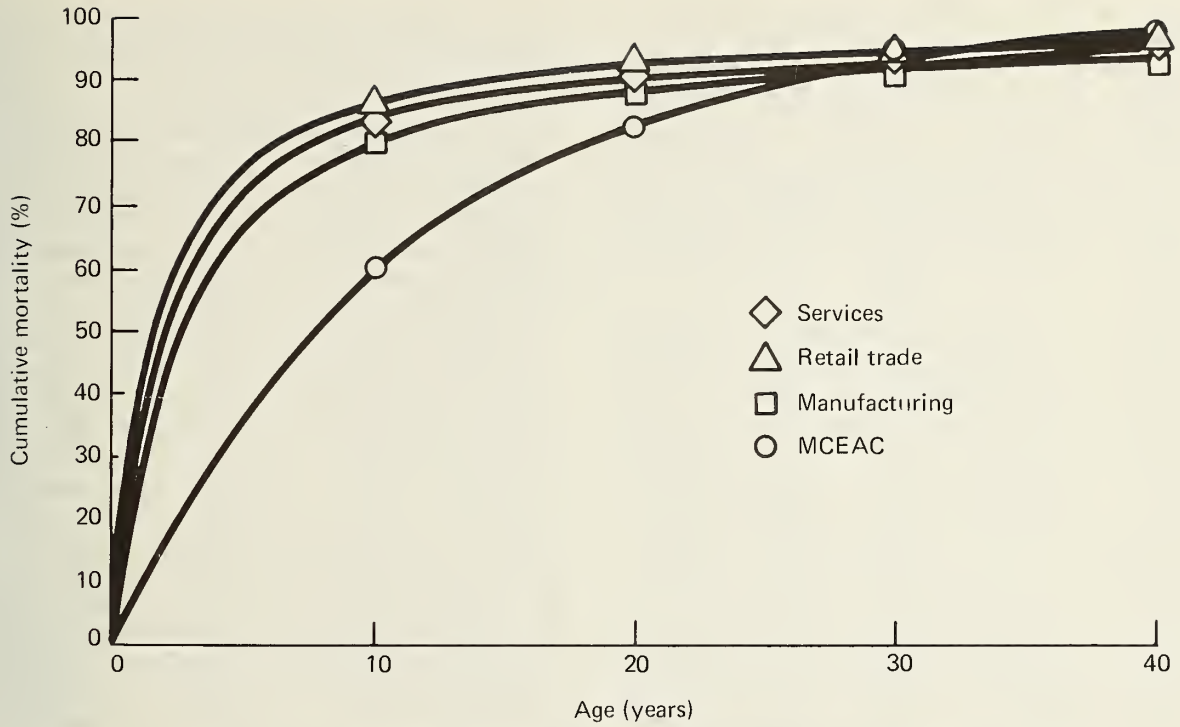


**Figure 5. Cumulative mortality, DBE data and MCEAC. Adapted from: Miklius and Casavant (12)**

estimated MCEAC cumulative mortality rates illustrated in Figures (4) and (5) under-estimate the observed survival of firms in the first part of the 13 year period for which data are available, and over-estimate survival in the later years. This, by itself, implies that the actual MCEAC CMF may be below that estimated by Miklius and Casavant, suggesting an even lower rate of turnover among firms. This conclusion must remain guarded, however, in the absence of more substantive mortality data. Valid time series mortality information should contain equivalent response rates from each age category, as well as accurate estimates of the yearly total population. The validity and comparability of the 1960 and 1974 MCEAC surveys is somewhat suspect in these two respects.

Alternatively, if the mortality data used in the above estimate is correct, the poor fit obtained with the Miklus and Casavant CMF may be due to unsuitability of the functional form utilized (equation 5). It is likely that carrier mortality is not a function of time alone; that is, economic variables affecting the business environment of MCEAC undoubtedly exert some influence on entry and exit.[5]

The veracity of the mortality estimates is admittedly tied to the assumptions made concerning entry and exit, and hampered by the lack of current mortality data. Still, based on existing evidence, it does not appear that the MCEAC industry, and AGEX carriers specifically,[6] undergo a cataclysmic failure of newly entered firms. Comparatively, MCEAC exhibit moderately lower exit rates in the first years of business life. Based on the Miklius and Casavant cumulative mortality estimate, about one-third of the exempt carriers five years old and less have exited the industry. If chronic over capacity existed, fueled by an unchecked entry of new firms, it is extremely unlikely that two-thirds of the MCEAC population could survive five years and more while failing to cover variable costs.

Given these relationships, the observed patterns of entry and exit of MCEAC associated with industry stability do not appear to impose burdensome real cost on society. The image of MCEAC suggested by the evaluation is that of competitive yet relatively stable enterprises. This stability is beneficial to agricultural producers and shippers insofar as insuring reliable transportation services. Inexperienced firms can fail and inefficient firms will fail, as in any competitive situation, but there is little evidence for attributing disequilibrium in this industry to the competitive sanctions enlivened by freedom of entry.

## Profitability

The notion of profitability is relatively easy to conceptualize in economic terms. In the traditional accounting role, profits—or losses—can be understood or observed as the difference between revenues and costs. The role of profitability with regard to performance evaluation, however, is not so

straight forward, nor so universally agreed upon (5 and 10).

Industry and/or individual firm profit levels are considered not only to reflect market competitive conditions, but also to influence technological change, product variation, and advertising, among other things (3). The anticipated dimension of performance associated with profitability developed in this study is more immediately concerned with the former aspect, the level of profits in the MCEAC industry.

Ideally, the profitability of individual MCEAC firms should be evaluated in terms of empirical profit and loss figures attributable to each firm. The MCEAC survey, however, did not solicit this information from respondents, nor was a secondary source of profitability data available which was adaptable to the MCEAC survey. The approach taken, therefore, was to evaluate MCEAC profitability in terms of its observable effects in the MCEAC industry. That is, certain operating characteristics of MCEAC made available from the survey reflect market and/or industry relationships which serve as proxies for profitability. Two evaluatory criteria derived from the MCEAC survey were selected in this respect: (1) firm entry and exit rates; and (2) firm growth.

The conclusions drawn regarding firm entry and exit in the two previous sections covering stability and responsiveness to demand have direct implications for profitability. First, the apparent direct correlation between changes in agricultural marketings and MCEAC entry suggests that these firms are responding to profit incentives created by increased shipper demand. Excess profits cannot build up for existing carriers so long as new firms can freely enter the market and compete, thus bidding down rates to competitive, market-clearing values.

Secondly, the exit or mortality of firms from the market must reflect, in part, the profitability of this enterprise. If a continual state of "cut throat" rate making exists, and no firms are able to cross subsidize their losses in other markets, a dramatic failure or exit of nearly all carriers should be evident within the first few years of business life. MCEAC firms simply cannot be expected to survive in the long run unless they cover variable costs. However, based on the mortality functions in Figures 4 and 5 no excessive turnover in new firms appears to have occurred in the MCEAC industry.

The growth in capacity of MCEAC firms can be interpreted as an indication of profitability, if the assumption is made that some portion of profits is reinvested in the firm, resulting in increased capacity or growth. A priori, the greater is the individual firm's profits, the greater is the potential for growth in any situation other than distinct diseconomies of size.

In perspective, the relationship between age and size reveals that MCEAC firms do not characteristically undergo significant increases in firm size as they age (Table 5). Ninety-two percent of all MCEAC less than six years old were firms of five or less power units, and 82 percent of the carriers over 40 years old were still five power units or smaller[7] More MCEAC firms added only one or two power units to their fleets than added 10 or more (Table 6).

There do not appear to be dramatic trends across the various performance measures with regard to profitability. The majority of all MCEAC either maintain static, small fleets or show only nominal increases in otherwise small fleets. This points to a relatively constant, normal profitability.

One possible exception to the above concerns the performance of regulated MCEAC. In descending order, BOTH, INTRA, and ICC carriers each showed a tendency towards greater increases in firm size than did AGEX carriers. Carriers of nonexempt commodities, who are logically regulated truckers, also exhibited above average growth. In part, this may be explained by the restricted entry in regulated carriage, which necessitates larger firm size in order to expand industry capacity. But it is also possible that the observed growth of regulated carriers represents a higher profitability on their part, due to these carriers' ability to combine exempt and regulated carriage into distinct, more efficient operations than

Table 5. Percentage distribution of MCEAC by age and size

| Size of firm by type carrier[a] | Age group in years | | | | |
|---|---|---|---|---|---|
| | 0[b]-4 | 5-9 | 10-20 | 21-40 | 41+ |
| Regulated:[c] | | | | | |
| 1-5 | 90.2 | 89.0 | 86.4 | 87.0 | 78.4 |
| 6-10 | 6.8 | 7.3 | 8.1 | 7.4 | 8.1 |
| 11-25 | 8.3 | 2.9 | 3.9 | 5.2 | 5.4 |
| 26-49 | 0.4 | 0.7 | 0.9 | 0.4 | 5.4 |
| 50+ | 0.4 | -0- | 0.6 | -0- | 2.7 |
| Unregulated:[d] | | | | | |
| 1-5 | 93.3 | 91.1 | 90.7 | 90.5 | 86.7 |
| 6-10 | 5.1 | 5.2 | 7.8 | 6.5 | 10.0 |
| 11-25 | 1.1 | 2.8 | 1.1 | 2.2 | 3.3 |
| 25-49 | 0.3 | 0.4 | 0.4 | 0.9 | -0- |
| 50+ | 0.3 | 0.4 | -0- | -0- | -0- |
| Total: | | | | | |
| 1-5 | 92.0 | 90.0 | 88.4 | 88.5 | 82.1 |
| 6-10 | 5.8 | 6.3 | 8.0 | 7.0 | 9.0 |
| 11-25 | 1.6 | 2.9 | 2.6 | 3.9 | 4.5 |
| 26-49 | 0.3 | 0.6 | 0.7 | 0.6 | 3.0 |
| 50+ | 0.3 | 0.2 | 0.6 | -0- | 1.5 |

NOTE: Columns may not sum to 100 percent due to rounding error.

[a]Size of firm is measured by total number of straight trucks plus truck tractors owned in 1974.
[b]The 1973 population is considered to be less than one year old.
[c]ICC, INTRA and BOTH
[d]AGEX

Table 6. Percent distribution of MCEAC by growth and by year started

| Year started | Growth[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | more than -5 | -5 to -1 | 0 | 1 to 2 | 3 to 5 | 6 to 10 | 11 to 20 | 20 to 50 | more than 50 |
| 1973 | 0.7 | 5.6 | 68.8 | 16.6 | 4.4 | 1.2 | 1.2 | 0.7 | 0.7 |
| 1972 | 0.2 | 6.8 | 57.2 | 20.1 | 10.3 | 2.5 | 1.3 | 0.6 | 0.2 |
| 1971 | 0.3 | 7.1 | 47.8 | 24.9 | 11.5 | 5.1 | 2.0 | 0.8 | 0.5 |
| 1970 | 0.5 | 11.4 | 48.6 | 20.9 | 10.1 | 5.0 | 2.6 | 0.3 | 0.8 |
| 1969 | 2.4 | 13.4 | 36.8 | 23.0 | 14.4 | 6.8 | 2.1 | 1.0 | -0- |
| 1968 | 2.0 | 12.7 | 41.8 | 19.9 | 10.0 | 3.6 | 7.6 | 2.0 | 0.4 |
| 1967 | -0- | 10.4 | 38.2 | 23.1 | 10.9 | 8.7 | 4.1 | 3.5 | 1.2 |
| 1966 | 1.9 | 6.9 | 34.6 | 21.4 | 17.6 | 6.3 | 8.8 | 1.3 | 1.3 |
| 1965 | -0- | 9.6 | 34.5 | 23.7 | 15.3 | 10.7 | 4.0 | 1.7 | 0.6 |
| 1964 | 1.4 | 8.8 | 34.5 | 23.4 | 15.2 | 9.6 | 4.1 | 2.8 | 0.7 |
| 1963 | 1.7 | 9.4 | 27.3 | 23.1 | 17.1 | 12.0 | 3.4 | 4.2 | 1.7 |
| 1962 | 0.8 | 9.2 | 34.2 | 24.2 | 15.0 | 10.0 | 4.2 | 2.5 | -0- |
| 1961 | 1.8 | 14.0 | 30.7 | 21.1 | 7.9 | 12.2 | 6.1 | 4.4 | 1.8 |
| 1960 | 2.4 | 10.1 | 39.1 | 16.6 | 13.6 | 8.9 | 4.7 | 3.6 | 1.2 |
| 1955-1959 | 2.2 | 8.3 | 33.3 | 19.4 | 13.9 | 11.5 | 6.9 | 3.8 | 0.8 |
| 1950-1954 | 1.9 | 10.4 | 33.5 | 18.0 | 13.8 | 9.7 | 6.8 | 5.1 | 0.7 |
| 1945-1949 | 1.4 | 7.0 | 32.7 | 18.4 | 19.4 | 9.4 | 6.1 | 3.9 | 1.6 |
| 1940-1944 | 3.6 | 6.0 | 28.6 | 17.9 | 21.4 | 10.7 | 6.5 | 3.0 | 2.4 |
| 1935-1939 | 1.9 | 5.0 | 31.0 | 18.6 | 17.4 | 13.0 | 6.8 | 4.3 | 1.9 |
| 1934 and before | 1.0 | 8.5 | 37.0 | 15.7 | 11.1 | 9.6 | 7.5 | 5.3 | 4.3 |

NOTE: Rows may not sum to 100 percent due to rounding error.

[a]Net change in the number of power units per firm since the year started.

their unregulated counterparts are capable of attaining. Whether this occurs because exempt commodities cross subsidize regulated commodities, or vice versa, cannot be determined with the available data. In either case, however, the agricultural shipper will benefit from the more efficient utilization of equipment by MCEAC.

## Capacity Utilization

Capacity utilization of equipment is perhaps the most visible measure of the technical efficiency of MCEAC in the context of use over time, mileage, and physical unit capacity. The economic consideration of capacity utilization entails not so much the absolute level of utilization, but, rather, the relation this absolute level bears to optimal capital investment and/or operating costs. The anticipated performance regarding capacity utilization is set in terms of predictable associations between utilization and selected economic factors bearing on MCEAC operations such as commodity hauled, trip length, and carrier operating authority. Each of these factors suggest directions of influence—either increasing or decreasing—on the capacity utilization of equipment by MCEAC. That is, the relative level of individual firm capacity utilization can be predicted, if not explained, in terms of the economic relationships involved. The correspondence of actual MCEAC capacity utilization as determined in this study with the predicted associations thus allows for the evaluation of this dimension of performance.

The primary measure of capacity utilization available from the survey was the respondent's estimate of the percentage of his total 1973 mileage which was without a load. The percent empty miles' estimate is perhaps most accurate in assessing capacity utilization over mileage or distance, and to a lesser degree unit physical capacity, to the extent an operator would logically associate the two. Utilization over time is not explicit in the empty mileage figure, but can be approached in an indirect manner through an analysis of average mileage per year per power unit.

Data regarding percent empty mileage by commodity hauled are reported in Table 7. Table 8 shows average trip length by commodity hauled.

Fruit and vegetable haulers experience a comparatively low level of empty mileage. This is attributable, in part, to the flexibility of application of their equipment in varied uses, and the wide distribution of shippers and buyers of fruit and vegetables across the United States. Fruit and vegetable movement is characterized by long hauls during a large part of each calendar year. Furthermore, fresh produce commonly flows into major consuming regions which increases the potential for backhaul ship-

Table 7. MCEAC empty mileage by major commodity hauled, 1974 sample

| Empty miles (%) | Fruits & vege-tables (%) | Poultry & eggs (%) | Grain (%) | Live-stock (%) | Cotton & wool (%) | Hay & forage (%) | Dairy (%) | Other exempt (%) | Non-exempt (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0-9 | 13.5 | 13.9 | 4.9 | 1.7 | 3.4 | 3.6 | 3.6 | 12.7 | 15.1 |
| 10-19 | 21.5 | 26.0 | 6.7 | 2.0 | 4.5 | 7.3 | 8.7 | 16.0 | 21.0 |
| 20-29 | 24.2 | 22.7 | 10.7 | 5.2 | 9.0 | 6.6 | 9.4 | 17.8 | 21.8 |
| 30-39 | 16.1 | 13.0 | 12.9 | 10.4 | 13.5 | 16.1 | 21.7 | 16.6 | 15.8 |
| 40-49 | 14.2 | 13.9 | 27.1 | 38.2 | 37.0 | 27.7 | 27.5 | 20.6 | 16.2 |
| 50-59 | 8.3 | 9.7 | 34.6 | 37.2 | 28.1 | 36.5 | 27.5 | 13.4 | 7.8 |
| 60-69 | 0.5 | 0.6 | 1.0 | 2.0 | 2.2 | 0.7 | 0.7 | 0.5 | 1.1 |
| 70-79 | 0.5 | -0- | 0.6 | 1.2 | -0- | -0- | -0- | 1.4 | 0.4 |
| 80-89 | 0.4 | -0- | 0.5 | 0.6 | -0- | 1.5 | 0.7 | 0.4 | 0.5 |
| 90-100 | 0.2 | 0.3 | 1.0 | 1.4 | 2.2 | -0- | -0- | 0.6 | 0.2 |

NOTE: Columns may not sum to 100 percent due to rounding error.

ments. In short, fruit and vegetable shipments by truck are sufficiently common, and nonrestricting, to enhance the carrier's utilization of equipment.

Livestock haulers, by comparison, are on the other end of the capacity utilization scale. Livestock transportation equipment is specialized in application and is used over typically short distance hauls. The exempt portion of livestock transportation is also very regionally oriented. On all three counts, the potential for backhaul is accordingly reduced, resulting in a higher percentage of empty miles. Similar analyses can be made on the other commodities. In general, capacity utilization tends to increase with longer distance trips, non-specialized equipment, and nonseasonal commodities. Conversely, utilization is restricted by short trips, specialized equipment and isolated markets.

It should be emphasized that the observations made and conclusions drawn regarding commodity groupings are generalizations. Undeniably, exceptions exist for every grouping. The purpose of the evaluation, however, is to test for the existence of the predicted associations of specified economic factors on capacity utilization, rather than to definitively analyze each commodity market. To the extent noted above, the MCEAC survey confirms that these tendencies exist. At the same time, these variables preclude a singular quantification of the appropriate "efficient" level of MCEAC capacity utilization.

Capacity utilization by type of carrier similarly reflects the influence of commodity hauled (Table 9). INTRA carriers, associated mainly with livestock and grain (Table 2), have the highest percent empty miles. ICC regulated carriers (ICC and BOTH) are more evenly spread among most common commodity hauled, and exhibit generally moderate empty mileage. AGEX carriers, primarily fruit and vegetable haulers, show the highest utilization.

In short, major commodity hauled appears to be a dominant feature insofar as factors are associated with percent empty miles. Moreover, the commodity hauled has a strong interrelationship with the type of operating authority held, as well as region of domicile.

In evaluating the overall level of capacity utiliza-

Table 8. Distribution of firms by major commodity hauled by length of haul, 1974 sample

| Length of haul (miles) | Fruits & vege-tables (%) | Poultry & eggs (%) | Grain (%) | Live-stock (%) | Cotton & wool (%) | Hay & forage (%) | Dairy (%) | Other exempt (%) | Non-exempt (%) |
|---|---|---|---|---|---|---|---|---|---|
| Less than 100 | 1.7 | 4.1 | 19.7 | 22.8 | 10.7 | 10.2 | 24.2 | 10.1 | 5.8 |
| 100 - 499 | 13.0 | 20.3 | 49.2 | 48.1 | 46.2 | 61.0 | 42.9 | 32.4 | 26.5 |
| 500 - 999 | 21.8 | 30.4 | 19.0 | 18.1 | 33.8 | 10.2 | 11.0 | 18.3 | 20.9 |
| 1,000 - 2,000 | 33.9 | 24.8 | 5.7 | 5.5 | 7.7 | 6.8 | 8.8 | 18.1 | 26.7 |
| 2,000 or more | 29.6 | 20.3 | 6.3 | 5.5 | 1.5 | 11.9 | 13.2 | 21.0 | 20.1 |

NOTE: Columns may not sum to 100 percent due to rounding error.

Table 9. MCEAC empty mileage by type of carrier, 1974 sample

| Empty miles (%) | AGEX (%) | ICC (%) | INTRA (%) | BOTH (%) | TOTAL (%) |
|---|---|---|---|---|---|
| 0-9 | 8.0 | 10.5 | 4.3 | 7.7 | 8.0 |
| 10-19 | 13.5 | 12.5 | 7.5 | 9.7 | 11.4 |
| 20-29 | 17.2 | 14.7 | 10.4 | 12.0 | 14.5 |
| 30-39 | 13.8 | 11.2 | 12.5 | 14.9 | 13.4 |
| 40-49 | 21.8 | 19.7 | 30.5 | 27.0 | 24.3 |
| 50-59 | 22.1 | 28.1 | 31.4 | 25.2 | 25.4 |
| 60-69 | 1.0 | 1.0 | 1.6 | 1.2 | 1.1 |
| 70-79 | 0.6 | 0.4 | 0.9 | 0.9 | 0.7 |
| 80-89 | 1.4 | 1.2 | 0.1 | 0.5 | 0.5 |
| 90-100 | 0.5 | 0.8 | 0.8 | 0.8 | 0.7 |

NOTE: Columns may not sum to 100 percent due to rounding error.

tion, it was found that size of firm varies inversely with percent empty miles (Table 10). Larger MCEAC show a significantly higher utilization of equipment than do the more numerous small fleet operators. Although a definitive conclusion cannot truly be made lacking more complete data, this relationship suggests that some economies of size may exist in the MCEAC industry.

Leasing practices by MCEAC tend to reduce excess capacity, but fall short of explaining overall levels of capacity utilization.

Based on individual MCEAC response estimates, the existing levels of excess capacity can be reduced. The precise magnitude of the reduction cannot be empirically derived, but nearly all MCEAC feel that their capacity utilization could be improved if access were granted to presently regulated commodities and markets.

Table 10. MCEAC empty mileage by size of firm, 1974 sample

| Empty miles (%) | Size[a] 1-5 (%) | 6-9 (%) | 10-24 (%) | 25-49 (%) | 50 or more (%) |
|---|---|---|---|---|---|
| 0 - 9 | 6.8 | 8.7 | 12.8 | 15.0 | 16.1 |
| 10 - 19 | 10.3 | 11.0 | 15.4 | 24.4 | 20.1 |
| 20 - 29 | 13.9 | 15.1 | 17.0 | 17.8 | 18.4 |
| 30 - 39 | 12.9 | 13.2 | 16.7 | 15.0 | 10.3 |
| 40 - 49 | 24.0 | 28.2 | 24.8 | 16.7 | 19.5 |
| 50 - 59 | 29.3 | 20.6 | 9.8 | 7.3 | 8.0 |
| 60 - 69 | 10.1 | 1.0 | 1.1 | 3.3 | 4.6 |
| 70 - 79 | 0.6 | 1.0 | 1.2 | 0.5 | -0- |
| 80 - 89 | 0.4 | 0.7 | 0.6 | -0- | 2.3 |
| 90 - 100 | 0.8 | 0.4 | 0.5 | -0- | -0- |

NOTE: Columns may not sum to 100 percent due to rounding error.

[a]Size is measured by total power units per firm.

## CONCLUSIONS

The analytical model used in this study has allowed for a comprehensive evaluation of the performance of MCEAC. Within the design of this model, it appears MCEAC performance corresponds closely to the anticipated dimensions of performance prescribed by both the legislative-judicial intent of the agricultural exemption, and the theoretical expectations of the MCEAC market. In this context, it must be concluded that the agricultural exemption is operating for the purposes for which it was designed in the manner expected.

Based on the MCEAC performance observed, the agricultural exemption has led to a competitive, efficient provision of transportation service to agricultural shippers and producers. While it appears reasonable to assume, in the absence of evidence to the contrary, that similar motor carrier performance could be achieved by extending the exemption to commodity markets in which the transportation service is presently subject to economic regulation, this study provides no direct evidence on this issue. Although specific instances of unresponsiveness to demand, instability, and operating inefficiency undoubtedly exist in the MCEAC industry, these situations were not observed with either the predictability or frequency which would confirm that a significant degree of resource misallocation is present in the agricultural transportation market. As a result, it must be concluded that such criticism is inaccurate, or at least misdirected.

Among the four types of MCEAC, the influence of state and/or ICC regulated operating authority is discernible, but there is insufficient evidence, given the data available, to conclude that regulated carriers exhibit a level of performance which is distinctly different from solely exempt truckers in the exempt commodity market. Operating authority has an effect, but is only one of many variables which impact upon MCEAC performance.

It appears that the variations in performance, as indicated by responsiveness, stability, profitability, and capacity utilization, are due to the manner in which individual carriers adapt to the market. That is, the ability of each MCEAC to combine the market variables into a transportation business ultimately prescribes his performance. Some MCEAC, through unique combinations of such variables as commodities hauled, routes, locations, leasing arrangements, and operating authority, have evolved as more efficient, more stable, and more profitable enterprises. However, it is important to recognize that the agricultural exemption itself is just another such variable in the scheme of sanctions confronting

a motor carrier. The performance of motor carriers by themselves has not been the central issue in this study so much as the efficacy—the performance—of the agricultural exemption. It is in this respect that the exemption is judged to have resulted in the performance for which it was designed.

## RECOMMENDATIONS FOR FURTHER RESEARCH

It is felt that some of the speculative relationships discussed in the preceding evaluations present intriguing opportunities for further research. Paramount in this respect are the questions involving economies of size, cross subsidization of revenues between exempt and regulated markets, the mortality of firms over time, and the technical efficiency of capacity utilization of equipment in the MCEAC industry.

There are other areas, in addition to those listed above, in which the understanding of the efficacy of the agricultural exemption could be improved through an expanded data base. Empirical MCEAC cost and revenue data, which covered a sufficiently broad sample of the MCEAC population as to include those operations noted in this study, would allow for more definitive conclusions in the associated ADP.

In the larger sense, further investigation into the area of intermodal competition is warranted. That is, the optimal pattern of agricultural transportation must be concerned with the most efficient means of transporting commodities. Improvements in railroad freight transportation may alter the current patterns of modal distribution of agricultural transportation, as well as the importance of the agricultural exemption.

Lastly, this study has closely examined the workings of the agricultural exemption, but not so the opposing efficacy of regulated truck transportation. The relative economic optimality of regulated versus exempt carriage in other commodity markets bears a more thorough investigation than presented here.

## FOOTNOTES

[1]The research on which this papoer is based was conducted while the author was a graduate assistant at Washington State University.

[2]This survey was sponsored by the Washington State University.

[3]In order to qualify as major commodity hauled, carriers must have reported that a specific commodity gourp comprised greater than 30 percent of total tonnage transported across state lines.

[4]The Miklius and Casavant research was directed primarily at MCEAC stability, and utilized the same MCEAC survey data used in this study. Their approach is well fitted, and accordingly adapted to this study. For a discussion of specific estimation techniques, refer to (12).

[5]This was demonstrated in the responsiveness to demand evaluation.

[6]The Miklius and Casavant analysis dealt specifically with AGEX carriers, in order to correspond with the earlier DeWolfe survey which excluded regulated MCEAC (12 and 4).

[7]The number of power units per firm (straight trucks plus truck tractors) is used as a proxy for firm size.

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# Performance of Unregulated Trucking in Australia[1]

James C. Nelson
Professor of Economics Emeritus
Washington State University

For real light on the churning issues over deregulation of economic controls of surface freight transport in the United States, the experiences of Australia, Great Britain and Canada are highly fruitful. This is because those countries have completely or largely deregulated road-rail freight transport, or have adopted a liberal, rather than a restrictive, regulatory policy, without experiencing the disastrous deterioration of freight services and facilities so often and so loudly claimed by the regulated carriers for the U.S. economy if similar policies were pursued.

While this paper concentrates on Australia, it is significant that in Great Britain neither the Government nor the principal parties in interest have recommended a return to restrictive quantitative licensing of lorries in the current comprehensive reexamination of British transport policy that is taking place as a result of the Department of the Environment's Consultation Document of April 1976 (9).[2] It is also significant that in Australia a recent proposal to return to some economic regulation of interstate road-rail transport was totally rejected. Thus, the Inter-State Commission Act 1975 of the former Whitlam Labor Government, as passed by the Australian Parliament in October 1975, did not contain any regulatory provisions that would change the completely free-entry conditions in interstate surface freight transport in that country; even as a purely investigative body, that Act has not been promulgated by the Fraser Liberal Government (1 and 2). What perhaps is even less known in the U.S. is that the road transport groups in Australia were opposed to the Whitlam program of some re-regulation, strongly preferring the continuance of free-entry conditions in interstate trucking and advocating further extensions of deregulation of intrastate trucking beyond South Australia and New South Wales (5). Finally, it appears significant that Canada, a neighboring continental country of similar background traditions as the U.S., still hesitates to effectuate Federal economic regulation of trucking; continues far less restrictive Provincial controls of inter-Provincial trucking than in the U.S.; and that even where long hauls and a resource-based economy makes railroading highly important in freight, the preponderence of informed people, including the significant shipper groups, have been in favor of continuance of the wide commercial freedom given the duopolistic railways by the National Transportation Act of 1967, with only relatively moderate tightening of the captive-shipper regulatory remedies.

The contrast in attitudes on the need for motor carrier regulation, as well as on commercial rate freedom for the railways, in those countries compared with those in the U.S. is sharp, indeed. This is particularly true of the positions of the motor carriers and the shippers. The Road Haulage Association in Britain voted last summer not to request a return to quantitative licensing in its submission to the DOE, though it would like some tightening of the qualitative controls as the EEC standards are implemented (21). This is in sharp contrast to the widespread and continuous publicity efforts of the American Trucking Associations, Inc. to paint disaster for American surface freight transport if road-rail were to be deregulated in the U.S. as sponsored by the Ford Administration and most economists. Whereas the industrial shippers in the U.S. are divided over the benefits of free-entry and free-market road-rail transport, although agricultural shippers saw the light in their support of exemption for regulation of haulage of farm products as long ago as 1935, the British shippers seem united in their support of continued free-entry conditions in trucking and of no freight rate regulation of lorries or railways in Britain.[3] And this seems as well to be the position of Australian shipper groups, including those in agriculture.

What accounts for these marked differences in the positions as to the present-day need for economic regulation and in the pressures exerted on Government by the truckers and shippers of Britain and Australia and those of similar groups in the U.S.? Are the Americans more knowledgeable of the *actual* economic effects of deregulated freight transport than the British and the Australians? Obviously, the British and Australian motor carriers and shippers know far more about how free-entry and rate-unregulated transport works out in terms of supplies and qualities of service and its price than the Americans who, except for private and exempt carriage, have only experienced freight transport that has been supplied under a restrictive entry-control system and with regulated and cartelized rate parity with the railways. The Americans are not entirely

happy with the high regulated and cartelized prices for road-rail freight services, with the empty return hauls of trucks due to certificate and permit restrictions fragmenting markets, and with the rail bankrupticies and the threatening spread of government subsidies to the railways. Yet, they are so paralyzed by fear of a breakdown of freight services under deregulated free-market conditions that they and their Congressional representatives fail to ask themselves why it is that deregulated transport can be workable in other like western countries but not in the U.S., the richest large economy in the world and, except in transport, the most ardent supporter of the competitive free enterprise market system and of strong antitrust laws. Plainly, the Americans, except in agriculture, seem to be the victims of a regulatory tradition which has spread a blanket of ignorance of the many benefits of real competition in surface freight transport. And many politicans have been misled by associations of regulated carriers and regulators who speak glibly as mere depression-minded theorists and self-serving advisers on how badly deregulated road-rail markets would perform in the U.S. and do perform in other countries.

## THE EFFECTS OF DEREGULATED INTERSTATE TRANSPORT IN AUSTRALIA

Clearly, the groups principally affected by the economic performance of deregulated transport firms in Australia and Britain, the shippers and the carriers, know well how they have been affected by the standards of freight service under free competition and competitive prices for trucking and road-rail services; and whether the competitive performance has been for the better, worse, or approximately the same as when there was restrictive economic regulation. When inquiries are made of those who live under deregulated freight transport, the repetitive responses that one obtains is that free-entry markets without restrictive conditions on entry into trucking and without minimum rate control to raise rates of return or to divide road-rail traffic have been very workable on the whole. Those conditions have been workable in terms of the continuing performance of the carriers in rendering ample and good-quality services at competitive rates both in the principal and rural markets; in improving the share of the market going to common carriers; in reducing carrier earnings to those only necessary to call forth the supplies of the varying freight services demanded; and in stimulating innovations by the competing carriers in equipment, operations, marketing, services, and in pricing.

The record of good results from deregulated transport in Australia, though difficult to differentiate as between agricultural and industrial markets, is a continuing one for more than 20 years since the relevant courts found that restrictive entry and rate or tax regulation of interstate commerce was unconstitutional (23). This prevented the states from continuing to prohibit or limit quantitative licenses for interstate trucking and from levying ton-mile taxes other than for road maintenance in order to reserve specified intercity interstate commodity traffic and hauls and revenues for the state-owned railways.[4] This brought about free entry competitive conditions in trucking over interstate routes, and these conditions very quickly and continuously have stimulated road-rail competition. The results of those free competitive conditions have been so beneficial overall that growing demands for deregulation of quantitative licensing and ton-mile regulatory taxes on trucking *on intrastate routes* have brought about deregulation in South Australia (1963–1968) and in New South Wales (1974), and that free-market condition is knocking on the door in Victoria, Queensland and Western Australia as well. This is hardly a record of dissatisfaction with deregulated competitive transport markets, nor has the actual record led to a general demand for re-regulation of road-rail in Australia as some American carrier and regulator interests would have the public believe.[5]

### Transitional Effects of Australian Deregulation

Stewart Joy, an Australian economist who studied the effects of interstate deregulation from 1954 to 1964, found that free-entry and tax-unpenalized truck haulage had both transitional and permanent effects, with the troublesome transitional effects ending in a few years as the constructive permanent effects took hold and continued (17, pp. 275–385).

Immediately after the 1954 Australian deregulation, there was a tremendous proliferation and expansion of trucking firms into haulage over interstate routes, particularly between the capital cities about 600 miles apart but also on many lesser interstate routes. The quick expansion of interstate trucking resulted in much rate cutting, some overloading of vehicles, excessive hours of driving, and considerable damage to highways not at that time adequately strong for heavy truck haulage. Though excesses of supply, fluctuating rates and business failures transitionally occurred, Joy found that market forces produced stability in the interstate markets by 1958, and that this was reinforced by more enforcement of load limits and driving-hour regulations. The more successful trucking firms established stable market positions and a lasting market structure composed of relatively few large trucking firms in intercapital markets partly or wholly using subcontracted owner-drivers, numerous smaller firms operating owned trucks, and up to 2,000 individual owner-drivers subcontracting to the large truckers and forwarders regularly or from time to time as traffic generation needs required. Rate stability returned,

but with flexibility of supply as a result of the many firms and subcontractors in the market and with sufficient rate fluctuations to equilibrate supply and demand.

## Permanent Evolving Effects of Australian Deregulation to 1964

Joy found that the market structure in interstate markets gradually changed as about 10 large nationwide truckers developed, each offering comprehensive service in general commodities and in small shipments, with terminal services and also services on a truckload basis. Mergers facilitated this development to obtain the economies of scale "in parcels and smalls groupage and agency functions," and the ability of large firms to command higher rates because they could "handle a widely fluctuating volume of traffic from each shipper" acted as an incentive (17, p. 279). But Joy did not find that monopoly had resulted in the intercapital markets, as competition existed between the larger firms themselves, between them and many smaller firms and own-account trucking, and between them and the railways. Nor did the market frequently or generally display excessive competition with rates below long-run direct costs. Joy's picture as of 1964 was that free-entry conditions had been conducive to the establishment of a stable and efficient trucking industry on interstate routes, highly competitive, and without serious monopoly or instability influences in rate fixation. Americans should note that in Australian long-distance trucking it did not require entry and operating-authority restrictions for the development of large, nationwide trucking-forwarder firms, capable of serving wide geographical areas and small as well as large communities, of handling efficiently many small shipments to varied destinations, and of giving speedy, dependable, and responsible services both to less-truckload and truckload shipments. This casts serious doubt on the need for the restrictively regulated and cartelized conditions in the U.S. since 1935 as a prerequisite for attaining stable and efficient large trucking firms for handling small shipments and for serving both large cities and rural areas with high-quality and dependable services.

Significantly, Joy also found that the state-owned railways reacted to rapidly growing trucking competition over interstate routes in highly beneficial and efficient ways. They moved quickly to complete the uniform-standard guage line between Sydney and Melbourne, the two largest cities with a combined population more than 40 percent of Australia's total. This greatly improved rail service on competitive routes, both for direct rail and for coordinated forwarder-trucker-rail haulage. Far greater emphasis was placed on wholesale rail hauling on quotation by the railways or attractive contract rates to freight forwarders (operating trucks on own account or with subcontractors) to supply them with full wagon loads of intercapital merchandise freight or to induce leasing of rail wagons or trains. This shift of freight traffic generation increasingly gave the long line hauls to the railways and left the gathering and distribution and other terminal functions to the truckers and forwarders who inherently can handle the retail traffic work more efficiently. The coordinated business was apparently profitable to both the railways and the truck-forwarders, has improved services to shippers at competitive rates, and has greatly grown in volume. The conclusion is inescapable that free-market conditions brought the benefits of greater economy to surface freight transport, of efficient road-rail coordinated services, and of competitive rates for shippers and the economy of Australia.

## Permanent Effects of Australian Deregulation to 1975–1976

Joy's undisputed findings on the economic effects of Australian deregulation have continued to describe the interstate market results since 1964 without monopoly conditions or excessive competition and its ills except briefly in recession periods. The gains from open competition in interstate markets have proved to be lasting rather than ephemeral. The only possible threat to continuance of enjoyment of those gains is the lessening number of multimodal freight forwarders by mergers and acquisitions of control from about 10 large trucker-forwarding firms to two or three. The lack of strong antitrust legislation until recently in Australia (7) may be a factor in the lessening number of such firms in the intercapital markets, but this has not resulted in monopoly service and rates nor in any lessening of the employment of forwarder-road-rail coordinated services.

As the main roads of Australia have been strengthened and improved though much road modernization remains to be done, long-distance through trucking has continued to be viable for high-quality services that cannot be provided by rail or by road-rail as dependably. A large number of large, medium-size and small firms still persist on intercapital routes of dense traffic flows, and the services of both road and rail carriers, including road-rail, have been in ample supply and of improved quality. Rate competition is still the rule in such markets, though trucking and forwarding associations have distributed standard rates or costs to their members and some informal agreements have occurred. Even in depressed periods as in 1974 the small owner-operators were reported to be refurbishing and replacing their equipment at interest rates of 15 to 20 percent (3). Owner-operators tend to make less than union drivers, but this has not diminished their numbers in the markets as they value being independent

business men, probably do not earn much less than union drivers, and do as well or better than in alternative occupations. Apparently, returns have been sufficient to large multimodal forwarders and smaller truck operators to make permanent the early stability conditions that Joy found to have replaced the initial transitional instability and to guarantee continually adequate and flexible service.

The continuing highly competitive conditions in the significant Sydney-Melbourne market are illustrative. During 1975, up to five multimodal freight forwarders hauled about 60 percent of the overland ton-miles by road in that market, and the other 40 percent was transported by the 60 to 80 trucking firms employing their own equipment and ranging up to 21 vehicles per firm. There were still about 2,000 owner-drivers, mostly with one truck each, serving this route with full truckloads. Of these, about 1,800 permanently subcontracted to the multimodal forwarders the year around. The remaining 200 were tramp operators, who shop for full loads at good rates when there is an excess of traffic to be hauled and at lower rates when traffic falls off temporarily. Equipment is laid up or transferred to other routes when traffic is slack and rates low.[6] With flexible entry and exit of trucking firms, with such large numbers of firms continuing over the years, with own-account trucking an alternative, and with continued railway competition, Australian shippers and governments seemed unconcerned that the lessening number of multimodal freight forwarders that are financially independent of one another and the enlarging role of coordinated forwarder-trucker-railway service will end up with monopoly services and prices in the intercapital markets. Rather, the expectations appeared to be that fluid supply and competitive markets can be expected to continue under deregulated conditions in Australia.

One notable achievement of deregulated markets that should have special notice is their contribution toward rapid development of coordinated road-rail transport in Australia. This can be attributed to a number of factors, one of the most significant of which is the freedom that freight forwarders have in Australia to operate their own or subcontracted vehicles *in line-haul service* or to contract with the railways for wagons or entire trains to carry forwarder freight on the intercapital line hauls (20, Ch. 1; and 10). This has encouraged the development of the large multimodal freight forwarders, firms that utilize complete trucking movements under their control where the service demands speed and certainty of delivery that cannot be met by alternative transport and the customer is willing to pay higher rates for such service; and where the service demands do not require such high standards of service, utilize the low-cost railways for the line haul and trucks for the gathering and distribution services, some of which take place from origins or to destinations far from the forwarder terminals. The large supply under free entry of owner-drivers also facilitates development of nationwide forwarder services, as does the freedom that the multimodal forwarders and railways have to agree on low contract rates for coordinated forwarder-road-rail services. The freedom that the railways have to compete with the road haulers in rates, too, tends to lead to efforts by the road hauliers to utilize railway services whenever cheaper and compatible with the services demanded by shippers. And the stimulus of long-distance road competition yielded railway service improvements such as extension of standard-guage lines and faster schedules, service on which forwarders can depend.

Contrast the high development of forwarder-road-rail services in Australia under deregulated conditions with the low incentives under regulated conditions in the U.S. for such coordinated transport to develop except in piggybacking. Whereas it is a standard practice in Australia for forwarder-trucker carriers to seek out line-haul coordinated service from the railways, it is exceptional for the truckers to do this in the U.S. except through piggybacking to relieve the capacity requirements for meeting peak demands. In the U.S., the regulated truckers have long opposed elimination of the restrictions on line-haul operations by freight forwarders, not because it would be inefficient but because it would lessen certificate protection from competition and limit trucker and rate-bureau control of the rates. Again, monopoly profit-making is placed before efficiency in intermodal transport. While some incentive for coordinated road-rail service in Australia may be due to the poorer main roads in that country, most of it comes from the greater incentives to innovation and efficiency that the free market and real competition provide.

So far as could be discerned from Australian studies and literature and from many discussions with carriers, shippers and government officials in Australia, the important lesson of the Australian deregulation experience as to interstate routes is that free entry in trucking and real competition in road-rail transport are highly efficient and self-perpetuating conditions. Instead of working disastrously toward instability of rates, services and carriers and toward insufficient supplies of high-quality services, as recurrently contended by self-serving regulated carriers and regulators in the U.S., unregulated competition works pretty much as would be expected from the explanations of the true economic theorists. Hence, the real theorists have been shown to be the realists whose deregulation remedies will economize on the use of resources in transport, will assure that shippers' varying service needs will be met at least rate cost, and will sponsor flexible and innovative adjustments between supply and demand. On the other hand, those who contend that disaster will occur in freight markets with deregulation appear to be the truly impractical pseudo theorists who are far off the mark in real-life terms!

## THE EFFECTS OF DEREGULATED INTRASTATE TRANSPORT IN AUSTRALIA

South Australia, which gradually deregulated intrastate haulage beginning in 1963 and completed it in 1968, provides the best evidence of the effects of intrastate deregulation. South Australia's experience has had time to accumulate and has been the subject of several comprehensive studies and a Royal Commission investigation. Knowledge of New South Wales' deregulation results will have to await time for it to work itself out and completion of a study authorized by the Federal Ministry of Transport (4).[7]

What the South Australia experience shows is that widespread satisfaction with deregulated transport was expressed at the hearings of the Royal Commission on State Transport Services by farmer groups, chambers of commerce, commercial and industrial shippers, and by the South Australian Road Transport Association, the most representative state association of road hauliers. Only the railways and outlying trucker groups wanted a return to restrictive quantity licensing (22, pp. 38, 39 and 41). And though the Royal Commission recommended this, the South Australian Parliament, responsive to the widespread acclaim for open competition in road-rail transport, rejected the Commission's advice and South Australia has continued its open competition policy. Of especial interest is the fact that farmers and housewives were prominently among those originally requesting deregulation and opposing its re-institution. The Gavan McDonell & Co. study for the Bureau of Transport Economics in Canberra contained a compilation of letters to editors and other communications from such public elements in support of deregulation (13). Would similar pressures from individual consumers and shippers help to overcome the self-advantaged carrier and regulatory pressure against deregulation in the U.S.?

Among the effects revealed by several studies of the South Australia deregulation were reductions in wool rates up to 50 percent and some reductions in wheat rates (6 and 14). These pleased the graziers and the grain producers, and the widening truck competition forced railways and truckers to quote lower rates to stay in the market. Another significant effect was the return of much traffic from own-account farmer and other shipper hauling to the common carriers, primarily by truck and to some extent by rail. There is no evidence that the greater road-rail and road-road rate competition has dried up services to rural towns and areas or has otherwise caused troublesome shortages of freight services. The for-hire road hauliers claimed to appreciate their greater freedom to compete with the railways; and while the railways complained that their revenues and financial conditions suffered from open competition with trucking and between road and rail carriers, the evidence available indicates that this effect was a limited one, applying to special traffics. It also indicates that the railways have given greater emphasis to long-haul movements and to interstate traffic, including forwarder-coordinated traffic. As many of the intrastate routes in the populated developed regions of South Australia were short-haul ones, the crowding out of the railways from some intrastate business probably benefited their financial condition. Expert opinion in government circles in Adelaide was that the deficits and financial difficulties of the railways were to be accounted for by other factors than deregulation of quantitative licensing—to such factors as use of the state-owned railways as employment generators, unprofitable passenger services, by stopping country trains and suburban trains, and the failure of the railways to adjust plant and services to competitive conditions in transport and the present-day role of rail transport in the system. Deregulation did not solve the financial problem of the South Australian railways, but it probably did not make it much worse. Rather, it forced adjustments that could, over the long run, materially help in operating those railways efficiently and more profitably.

This suggests mention of a widespread problem in Australian transport today. That is the rising and very large deficits of several state-owned railways in recent years, especially in South Australia, Victoria and Tasmania (16). This is a complicated situation, only partly due to the widening of truck competition under free-entry conditions. Each Australian state developed its railway system to cover all developed areas of the state and to facilitate the flow of exports and imports through its principal port city or cities. The state railways, especially in Victoria, still maintain large mileages of branch and secondary lines into rural agricultural areas; and they maintain widespread country passenger train services and very highly developed suburban passenger train services, especially in Melbourne and Sydney. Through political control, the states have generally kept suburban and country passenger fares low and schedules ample, and some freight rates have been depressed to protect farmer incomes and to stimulate industry development and exports.[8] In Australia, the railways have high ratios of employees to output. And though the state treasuries and the Federal Parliament are concerned over the problem of the rising railway deficits, the labor unions and the Australian people, as one can easily learn from the newspapers, seem relatively unconcerned with whether the railways operate profitably or not. They appear to prefer to have the railways continue to give unprofitable country passenger and merchandise freight services and unprofitable suburban passenger services as well as profitable services, and to use the railways as large employers of unionized labor. In such circumstances and with the difficulties of obtaining energetic management of state railways operated under mixtures of commercial efficiency and social goals, it is not sur-

prising that deficit operations are becoming the rule. Nor is it surprising that the state-owned railways would experience increasing deficits in the high inflation of the 1970s, especially at a time when the State and Federal Governments were emphasizing full employment goals more than inflation control and profit and efficiency goals for the economy and the railways.

## CONCLUSIONS AND IMPLICATIONS

Deregulated interstate freight transport by surface carriers has continued for more than two decades in Australia. It has been a substantial and widely-recognized success, rather than a disaster, for consumers, farmers, industrial and other shippers, large and small communities, and for motor carriers and freight forwarders. Its achievements and promise have prompted intrastate deregulation in South Australia and New South Wales, and further intrastate deregulation is on its way or has partially taken place in other states. Deregulation of intrastate routes has been a success in South Australia, and probably will be in New South Wales. A Labor Government move to enact some largely unspecified re-regulation that may have intended restrictive entry control as well as discrimination controls of railway rates was defeated (along with that Government) during 1975, and continuation of the ad hoc investigatory body without regulatory powers has not been promulgated.

Deregulation has not solved the railway deficit and plant, service and labor redundancy problems, but the increased intermodal competition under deregulated conditions has stimulated the railways to innovate in services and rates; to contract with multimodal forwarder-truckers to handle the long line hauls of high-value manufactures and to regain market share of intercapital traffic; and though the railways appear to think they were or are better off under the restrictive intrastate regulation that has continued in some states to protect their intrastate markets and revenues, the facts assembled in Victoria by the Bland Report seriously question that the remaining restrictive regulation in that State can save that large system from carrying out a fundamental reorganization and retrenchment of branch and lesser mainline facilities, freight and passenger schedules and services, and unprofitable merchandise services to many short-haul regional centers in that State (8). In short, faith in solving railway deficits and redundancy and productivity problems by regulatory protection of their intrastate markets is fast disappearing, and hope that the remaining restrictive intrastate regulation can protect the state-owned railways from fundamental change, including in their managements, is giving way to realistic reappraisal of the real railway problems and efforts to find solutions that will improve productivity, utilize railway facilities in service and traffic areas of best advantage and economy, and bring about retirement from terminal services and short-haul carriage of merchandise freight for which the road carriers are far more efficient.

Free entry for trucking and forwarding carriers and commercial freedom for them and the railways have hastened intermodal innovations in the intercapital markets; greatly increased road-rail coordinated hauling; improved service quality by road, road-rail and rail; contributed to efficient handling of merchandise and other traffic in terminals and in gathering and distribution as well as over the long line hauls; has lowered the real cost of long-distance freight; and has strengthened the market sharing of the railways in the significant interstate routes; and, in addition, has promoted efficient development of trucking and forwarding under competitive conditions. Few serious problems have arisen in surface freight transport in the intercapital markets, except for some concern as to whether rail line capacity will be sufficient, continued expressions of truckers and motorists that the main highways require modernization and more lanes, and the usual questions concerning the extent and economic role of rail passenger train services and the adequacy of truck user fees to cover public and social costs. Almost all groups claim to benefit from the competitive conditions that have obtained in interstate surface transport—farmers and rural people as well as urban residents, including other main highway users and environmentalists. This explains why they and shipper and road carriers have sought freedom of choice between road and rail and open competition has come in intrastate freight transport in South Australia and New South Wales and will surely come in most or all Australian states.

The principal implications for the United States are obvious. Australian experience has demonstrated that free entry and full competitive conditions in surface freight transport are viable, efficient and self-sustaining. Under those conditions, carriers provide high-quality and ample services at efficient costs and rates both to dense and rural markets, and they innovate more in operations, services and rates. Monopoly markets are not substituted for competitive ones as under restrictive entry control and cartelized rate fixation, and excessive competition and unstable conditions do not become characteristic of transport markets and the road transport industry. The good results of deregulated transport and the failure of restrictive state regulation to solve railway problems in Australia should encourage shippers and consumers to demand prompt action to deregulate interstate surface carriers in the United States; Congressmen to look objectively into the facts of how markets work under free-entry conditions in Australia, in Alberta, Canada and in Great Britain; and the regulated carriers to realize that they can be well off, many of them better off, under true competitive conditions

than under cartelized regulation, and in any case, that they are fighting a losing battle in trying to convince the American public that deregulated conditions will prove a veritable disaster for surface freight transport in the United States.

What it apparently takes to induce American carrier entrepreneurs to enjoy, and not to fear, competitive free enterprise is to restore it to the freight markets so that they can again, or for the first time, learn how private enterprise really works under true competitive conditions! If this were done, they would be greatly surprised to discover how foolish and redundantly theoretical they have been in trying so hard and so long to sell the American shippers and public of the virtues of restrictive regulation limiting competition in terms of rates and service benefits to consumers. They might even eventually come to understand that they have really been self-serving in placing their own security from effective competition and their own returns from noncompetitive markets ahead of their alleged concern for the interests of users, consumers, small communities, and rural areas.

## FOOTNOTES

[1]During the First Term of 1975 (February-June), Professor Nelson was Visiting Professor of Economics, Department of Economics, Monash University, Clayton, Victoria (suburb of Melbourne). During and since that period, he has researched the economic effects of interstate and intrastate deregulation of transport in Australia.

[2]Evidence of the high interest in the road-rail problem, the future economic role of British Rail, the big truck problem on British roads and streets, commuter and long-distance rail passenger services and fares, and in environmental issues is the fact that this Consultation Document (9) stimulated more than a 1,000 responses to the DOE, a veritable gold mine of information on British transport policy, including on how complete reliance on the free unregulated road-rail freight markets have worked out in the last decade or longer.

[3]Based on (15) and discussions with Mr. Brian Fowler, Assistant Director, Commercial Services Division, National Farmers Union, London, England, September 27, 1976.

[4]For a precis of restrictive licensing and ton-mile taxation for carriage of goods by road by intrastate application in each Australian state as of 1971, see (6; 22, pp. 6-11; and 18).

[5]See the erroneous impressions of Patricia Cavanaugh in (11 and 12). What demand there is for re-regulation is from the formerly protected state-owned railways and some union or unionizing groups or from those concerned with the unequal pull of ports for grain, wool and other traffic. For example, much railway traffic from and to New South Wales moves through the Port of Melbourne in Victoria largely because of its overland distance advantage to and from some interior producing areas in New South Wales. This is true of wool.

[6]Derived from discussions with A. P. Beamish, Director, Victorian Road Transport Association, South Melbourne, Australia, on March 5 and April 8, 1975. Existing transport studies in Australia do not assemble specific data on the number of competing trucking and forwarding firms in particular markets. For some helpful data, see (20)

[7]The study is by H. M. Hassall and Associates/Gavan McDonell and Company and covers the effects of the N.S.W. Transport (Co-ordination) Act on the freight transport industry of the State during five years ending December 1973. Deregulation took effect on January 1, 1974. It is expected that effects under deregulation will also be examined.

[8]For example, the following comment appears in (6, p. 21): "On May 1, 1971, the State Government announced a maximum rail freight of $3 per bale on wool consigned to Sydney and Newcastle. The difference between the by-law rate then existing and the $3 per bale ceiling is made up to the N.S.W. Railway by the State Treasury. The difference at that time could be as high as $1.08 per bale."

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# Regulatory Reform and Motor Common Carrier Service to Small Towns and Rural Communities

Georgia Canellos
Economist, Office of Regulatory Policy Analysis
U.S. Department of Transportation

On November 13, 1975, the Administration submitted to the Congress a major legislative proposal for changes in Interstate Commerce Commission (ICC) economic regulation of the trucking industry. This bill, the Motor Carrier Reform Act (MCRA), has as its key objective the stimulation of greater competition and market responsiveness in interstate trucking. The need for this bill is based upon substantial evidence that the existing system of economic regulation practiced by the ICC has severely blunted healthy price competition and unjustifiably denied would be, qualified applicants a reasonable and equitable opportunity to enter the interstate trucking industry.

One of the key objections most frequently raised by opponents of this legislative proposal is that, unless competition is restricted, motor carrier service to small, rural communities will deteriorate. The Commission's current restrictive entry policy, they maintain, confers both benefits and obligations upon certificated carriers. The carriers benefit by being protected against potential new competitors in the towns and cities which they are authorized to serve, and in return they have a "common carrier obligation" to provide service to these towns and cities. Without this obligation, it is alleged, small rural towns would not receive service.

The reasoning behind the above argument is that rural service is inherently unprofitable if left to free market competitive forces. Motor carriers can only afford to provide such service if competition in rural markets is restricted. Furthermore, the argument goes, carriers need to earn profits elsewhere, which they can use to support service to rural areas. Thus, competition must be limited in high density interurban corridors, as well, so that common carriers will have the wherewithal to support rural service. Restricted competition in urban and rural markets is the *quid pro quo* for regulated carriers undertaking the common carrier obligation to serve rural areas.

In fact, however, no hard evidence has yet been presented to document the validity of the above arguments in assuring that a reasonable level of regulated motor carrier service will be provided to small towns and rural areas. On purely practical grounds, there is good reason to be skeptical about any governmental body's ability to oversee and enforce the common carrier obligation for some 15,000 motor carriers, carrying thousands of varieties of commodities, from and to literally hundreds of thousands of origin and destination points throughout the United States. In addition, most reform advocates find it difficult to believe that business-minded motor carrier firms (and what other kinds of firms are there in the marketplace?) voluntarily take profits from their lucrative operations and pour them into money-losing operations for the sake of quality, consumer-responsive service to small towns and rural areas. Cross-subsidies, unless they can be measured and monitored, tend to be very elusive creatures of questionable magnitude and lineage.

All in all, in the face of valid social concerns about the quality of transportation service to small towns and rural areas, it is imperative that we critically examine the facts of regulation and the quality of trucking service to such communities. To this end, I would like to share with you some recent research findings on this issue.

## THE COMMON CARRIER OBLIGATION

A very important study of regulated motor carrier service in nine western states of the United States has turned up substantial new evidence on ICC carriers' adherence to their common carrier "obligation" (2). This study, done for the Federation of Rocky Mountain States, developed and analyzed data regarding the availability of regulated carrier service and the structure of freight rates in nine western states: Colorado, New Mexico, Utah, Idaho, Montana, Wyoming, Nebraska, North Dakota and South Dakota. The study surveyed a total of 1,032 cities and towns within the nine state region. It found that all of these towns were authorized some type of regulated motor carrier service. What was of prime interest, however, was a detailed examination conducted by the Wyoming Public Service Commission (PSC), looking into the actual extent to which the ICC regulated motor carriers actively exercised their common carrier obligation within the largely rural State of Wyoming. The Wyoming PSC selected 11 towns to study: Casper, Cheyenne, Cody, Gillette, Jackson, Laramie, Newcastle, Rawlins, Riverton, Rock Springs, and Sheridan. These towns are among the larger towns in the State and thus, if anything, overstate the extent to which service is actually provided in small towns.

The Wyoming PSC found that on the average, only half of the carriers authorized to serve any one of the 11 towns actually were doing so. Of these, the larger carriers appeared to be serving in truckload lots only. Clearly, certification was not imposing an actual obligation to provide service. Furthermore, based on the Wyoming study, the number of authorized carriers for the entire nine-state Rocky Mountain region may be twice the number actually providing service. If so, this would mean that about one-fourth of the 1,032 towns in the nine-State region are served by no more than one carrier, and over half (56 percent) are served by no more than two carriers.

Additional evidence on regulated carriers' fulfillment of their common carrier obligation to small and rural towns is also coming forth from a DOT staff study on motor carrier pooling agreements. This study, the final draft of which is now in preparation, and will be ready for release shortly, was instituted to examine the recent phenomenon of formal ICC motor carrier pooling arrangements. The study documents how service pooling agreements have arisen at the initiative of long-haul ICC interstate carriers seeking to avoid direct line service to small towns and rural communities.

These agreements involve formal legal contracts between carriers to engage in interline activities. However, the agreements differ from ordinary interline arrangements in that, under pooling, one or more long-haul interstate carriers combine with local short-haul carriers to make certain common arrangments for serving points to which the long-haul carriers themselves hold direct operating authority. Thus, these agreements work to relieve the long-haul carrier(s) of the obligation to directly serve "undesirable" points. Simultaneously, however, the study uncovered no evidence to suggest that the long-haul carriers engaged in such agreements were subsidizing their short-haul colleagues for the direct portion of the local service provided by the latter.

Pooling agreements generally have worked to restrict competitive opportunities for carriers not party to the agreement. Excluded carriers unquestionably are hampered in exploring possible alternative efficient arrangements for meeting the needs of local shippers and receivers. In some cases, the pooling agreements rapidly seem to have led to the demise of local carriers excluded from the pool, resulting in a reduced number of ICC carriers providing service to small towns.

In very significant ways, the existing rigid system of ICC entry and rate regulation has acted perversely to foster the development of anticompetitive pooling agreements to assure regular service to small towns. For example, under the existing system of entry regulation one or more long-line regulated carriers may be authorized to serve two or more major trading centers, including the intermediate points between the major centers. However, because of low tonnage volumes originating at and destined to these intermediate points, the carrier(s) may not find it profitable—under the current rate structure—to make daily pickup and delivery trips to these areas.

Nevertheless, neither are long-haul carriers willing to relinquish their ICC operating rights to serve presently unprofitable points, since the points may become profitable at some future time. Also, in most instances, the Commission will not allow a carrier to relinquish rights to serve intermediate points and at the same time preserve its operating authority to continue serving the major trading centers. Neither will the Commission recognize ordinary interlining arrangements with local carriers as a legitimate means for line-haul carriers to meet their common carrier obligation to assure regular service to intermediate points. Hence, long-haul carriers have sought ICC-sanctioned formal pooling agreements as a means of retaining direct operating rights to presently "undesirable" points, while not actually providing a direct service to these points for the present.

In practice, however, as is documented by the Rocky Mountain Study, there also are cases where long-haul carriers simply cease serving points which they are legally required to serve. These instances of "dormant" rights generally go unnoticed by the ICC unless they are specifically called to its attention through complaints from shippers, receivers, other carriers, or State agencies. The carrier with the dormant rights, of course, has no self-interest in calling such rights to the attention of the Commission, as it might like to retain such rights for possible future use or sale. Alternatively, the carrier may fear that a

request to the Commission for partial revocation of rights only to undesirable points might also result in the Commission's revoking rights to desirable points, such as end-to-end major trading center points. Thus, allowing rights to become dormant without ICC notice of such preserves a carrier's options for serving certain points, while circumventing the common carrier obligation to provide presently undesirable service.

At the same time that certain long-haul ICC carriers are seeking to avoid small town rural points, however, there are other ICC carriers who are engaged in extensive operations to such points. Some insights regarding these carriers are reported in a study done by R. L. Banks and Associates for the Department of Transportation (4). This study, "Economic Analysis and Regulatory Implications of Motor Common Carrier Service to Predominantly Small Communities," looked at a select sample of Class I and II ICC regulated carriers of general freight who were engaged in extensive service to small cities, towns, and regions—combined with service to no more than one large city and/or two medium-sized cities (cities of over 50,000 population). Out of an initial sample of 35 such carriers, one carrier in each of the nine ICC-defined geographic areas then was chosen for extensive study.

A key finding of the Banks study is that the studied firms were providing service to small communities basically in three ways: (1) as operators to rural areas out of one or two large base cities, (2) as state-wide operators in States of relatively low population, and (3) as operators in relatively high-population States, but serving primarily the less densely-populated areas of such States. These carriers were generally about one-third the size of the average Class I ICC regulated carrier, as measured in terms of vehicle miles, ton miles, and operating revenues. They also had lighter average loads, shorter average hauls, and lower average weights per shipment than the average for ICC Class I and II intercity carriers of general freight (ICC Instruction 27 carriers). Only about two percent of their total shipments constituted truckload shipments. Furthermore, all of the sample carriers were profitable, a criterion in their selection for extensive study.

Personal interviews were conducted by the Banks staff with management officials of each of the sampled carriers. In the interviews the carriers reported that they were serving in small, short-haul, LTL markets which larger ICC carriers have largely neglected in recent years. The majority of the carriers stated that dormant rights existed in many of their markets. This appeared to be because:

> ". . . performance of service is not policed by the ICC nor any State commission on its own initiative, and is only investigated when complaints are received from shippers. If other carriers serve a location, a carrier can generally terminate service to that location, and the shippers will use the services of other carriers rather than file a service complaint with the State commission or the ICC" (4, p. 34).

Yet, the interviewed carriers were performing in such markets, and still showing a net overall profit on their books!

The overwhelming impression of the Banks staff subsequent to the interviews, to quote directly from the study, was that the interviewed carriers:

> "Succeed because they are specialists in serving markets requiring the kind of attention which appears to be uneconomical for large carriers to offer. In essence, small carriers appear to be better equipped to handle shipments in small markets because their pickup and delivery service, as well as terminal operations, are geared for small LTL shipments; their managements maintain close relations with customers, tight control over their organizations, and pay close attention to changing market conditions" (4, p. 5).

For these carriers, one might presume that it is not the common carrier obligation which accounts for their servicing small communities, but the economic rewards which they reap by efficiently specializing in such service.

A final source of interesting recent information on regulated carrier service to small towns and the common carrier obligation is, ironically enough, the survey reported by the American Trucking Association (ATA) in its "Small Town Blues" pamphlet (1). In early 1976 the ATA mailed out a survey questionnaire to some 3,400 Class I and II regulated motor carriers. The questionnaire contained three broad questions regarding continued carrier service to presently authorized points in the event the common carrier obligation was to be totally abolished. Nine hundred (900) firms responded to the questionnaire, for a survey response rate of 26.2 percent.

The overriding purpose of the ATA's "Small Town Blues" pamphlet was to make the case that deregulation would have a disastrous impact on ICC carrier service to small towns. Since many ICC carriers firmly have gone on record in opposition to deregulation, a survey of them (particularly a survey concentrating only on the larger Class I and II carriers) should result in feedback predicting severe negative impacts which would be brought by deregulation. Indeed, the first survey question seems designed to elicit such feedback.

Question one begins with the statement: "As a general rule, service to smaller communities by for-hire carriers may frequently be uneconomical" (1, p. 6). Of course, the truth or falsity of this assertion is yet to be proven. Then the question was posed: "If your company were not required by its certificate to serve all the points which it does serve under regulation, would you suspend service to one or more points?" Over one-third of the respondents answered "NO" to this question!

The latter response clearly reveals that while some large Class I and II ICC carriers voluntarily may not

want to provide service to all points to which they now have a common carrier obligation, nevertheless a substantial number of such carriers are interested in voluntarily maintaining all of their present operations. Furthermore, question Three of the ATA survey posed a direct follow-up query: "If your company were not required to serve any community it does not wish to serve, as a rule of thumb, what would be the smallest size community in terms of population to which you would offer regular service?" Despite the phrasing of this question (regular service rather than just service, or irregular route service), 46 percent of the respondents indicated they would be willing to provide regular service to communities of *under* 5,000 population. Nearly 90 percent of the respondents would maintain service to communities of 10,000-20,000 population! Less than 4 percent of the responding carriers indicated they would voluntarily maintain service only to communities of greater than 50,000 population.

The ATA survey yields no findings on any communities which would lose *all* common carrier service, were total deregulation to take place. Question Two of the survey did ask: "If regulated transportation were eliminated, to how many communities do you estimate you might stop service?" From the reported responses to this question, however, it is not possible to determine whether individual carriers exiting from markets which they presently serve would leave any communities totally without common carrier service. In fact, the reported response is quite confusing in that it indicates that a "weighted average" of 2.7 percent of the respondents would eliminate service to *all* communities which they presently serve. Why and how a weighted average was used to report this response, and whether the response of the latter 2.7 percent means these carriers would totally depart the trucking industry in the absence of regulation is not explained in the pamphlet. Certainly, it is hard to believe the latter carriers are losing money in all of their present markets and yet have remained in business simply to fulfill their regulated common carrier obligation.

Despite ambiguities in interpreting the response to question two, it might be noted that some 30% of the reported responses indicated that no service would be eliminated to communities which carriers presently serve. Coupled with the results of questions one and three, the survey clearly reveals that a substantial number of ICC truckers would continue all their present operations even in the total absence of any common carrier obligation (something which current reform proposals have by no means suggested). Furthermore, even in appealing to carriers who might be presumed not to be interested in small town business (the larger, Class I and II ICC carriers), the survey found a substantial number of respondents interested in providing *regular* service to small towns. Finally, for the 2,500 firms who did not respond to the survey, and for the over 11,000 smaller, Class III ICC carriers who were not included in the survey, it seems highly likely that such carriers would be even more favorably disposed to providing small town service than those responding to the ATA's survey. There simply is no clearly documented basis for arguing that regulation which restricts competition, while imposing a common carrier obligation on carriers, is or has been relevant in assuring a reasonable level of general freight service to small communities.

## THE CROSS-SUBSIDY ARGUMENT

As to the argument that regulaion has enabled small towns to receive a cross-subsidy on ICC carrier service, the studies cited above also shed important new light on this argument. For example, the above cited study for the Federation of Rocky Mountain States extensively investigated the freight rate structure throughout the nine-state region studied. Over and over again, the study documents cases of "capricious and inconsistent" rates on shipments to small, rural communities (2, p. 139).

One finding of the study was that for shipments to smaller towns, rates for a given commodity class often are higher for shorter distances than for similar shipments over longer distances in the same direction to other towns in the same region, and even over the same routes. To cite a couple of cases, the following are for class 100 LTL rates from Dallas to points in Colorado:

1. In the Southeastern corner of Colorado a group of towns are charged $8.22 per hundred pounds for shipments from Dallas, whereas another group of towns just north of the first group, on the same highway, and farther from Dallas, are charged $7.53 per hundred pounds (2, p. 130).
2. In the Southwestern portion of Colorado a group of towns starting in the vicinity of Alamosa is charged $11.75 for shipments from Dallas. Beyond this group and farther from Dallas are two groups of towns charged lower rates. One centers on Salida and is charged $10.98. One centers on Grand Junction and is charged $11.50 (2, p. 130).

The study finds that "generally, there is no continuous, uniform relationship between mileage and the subject freight rates as described above" (2, p. 85).

Another finding of the above study on freight rates to particularly rural shippers and receivers, was the frequent application of so-called "arbitrary" rates on shipments to and for these parties. Arbitrary rates are applied for small towns which normally generate such small volumes of freight traffic that carriers do not publish separate rates to each of the towns individually. Frequently, a number of such towns within a given region are combined together into a "rate group," and a single-factor through rate is published for the entire group. However, the Rocky Mountain

study discovered in examining the prevalence of through rates in the study area, that through rates are published only to a limited number of rate groups; many small points are not even covered by these rate groups. When the latter situation exists, "arbitrary" rates are constructed by carriers for shipments to and from non-rate group points, from intermediate interchange points to which standard rates are published.

The striking feature of arbitrary rates is that, indeed, they do appear truly to be arbitrary. The study found that "the arbitrary rate between an interchange point and a final destination is almost always different when one approaches from a different distant origin regardless of the fact that the physical journey from the interchange point to the destination is exactly the same in each case" (2, p. 125). For example, the cost of shipping of goods from Trinidad, Colorado to Allenmine, Colorado is over 20 percent higher if the trip originally starts in Dallas, than if it originally starts in Los Angeles (2, p. 125).

Another significant "peculiarity" found by the study in the way arbitraries are applied is that frequently arbitrary rates are imposed *on top* of already existing group rates to towns for which the latter types of rates are published (2, p. 126). Finally, the report found that arbitraries are applied for some shippers but not for others, and for some towns but not for others. For instance:

> ". . . several carriers 'flag out' or choose not to apply the arbitrary at Golden, Colorado. Several carriers remove application of the extra charge only for one large industry located at Golden. There are, however, several industrial sites along the route between Denver and Golden to which the arbitrary rate is applied" (2, p. 139).

Over 150 pages of examples of rate relationships such as these are contained in the Rocky Mountain study. In generalizing on such findings, the report makes the following observation:

> "The establishment of freight rates is generally supposed to be based upon economic factors, the ultimate of which are the cost to the carrier for providing the service and the need or demand of the customer to have it. The major rate theory behind arbitrary rates, however, is summed up in their name—they are established arbitrarily. Economic factors may be considered in their establishment but probably only in an intuitive way" (2, p. 123).

Certainly, such findings cast considerable doubt on the contention that rural communities are receiving motor common carrier transportation service at below-cost, subsidized rates. Moreover, the general picture that emerges on rates to rural communities is that they are by no means fair, or consistent, or related to costs. And the small rural shipper has little recourse under the present system. The cost and inconvenience of a formal protest are out of the question. And the shipper has no opportunity to "shop around" for a more satisfactory alternative because price competition is effectively precluded by the regulatory system. He either accepts the situation or turns to private carriage.

Additional questions are raised about the extent of cross-subsidies to rural communities in the pooling agreement study being completed by DOT. In examining the terms of ICC-approved pooling agreements among carriers, the study found that the revenue divisions between the long-haul and short-haul carriers involved in pooling arrangements generally are no different from revenue divisions on joint carrier movements in ordinary interlining situations. In both cases an established procedure, based on the use of so-called *Beranek's Factors*, is generally used to calculate the division of revenue between carriers participating in the joint line movement. Application of the Beranek's Factors involves the use of tables which have been developed for interline trips to and from tens of thousands of points throughout the United States.

Pooling, as well as ordinary interlining arrangements, are not forced upon carriers by the ICC, but are voluntarily entered into by carriers. Similarly, the terms of these arrangements are voluntarily negotiated by the participating carriers. It seems logical to assume that carriers would not voluntarily enter into such arrangements if they were not mutually profitable to all parties concerned. Moreover, the general absence of unique revenue division arrangements in pooling agreements (designed to provide continuous common carrier service to small, rural communities), as opposed to the terms in regular interlining arrangements which assure continuous service to towns and cities of all sizes across the country, makes one wonder how and where motor carrier service specifically to small towns is being "cross-subsidized."

A few exceptions to the above revenue division arrangements have been found in pooling and interlining arrangements to small towns. The most usual type of exception seems to be where more than two carriers are involved in a total joint-line movement. When only two carriers are involved, the total amount of their charge for service to a point for which a single-line rate is published is usually no different from the single-line rate. However, where a third carrier also is involved (particularly as the short-haul, final delivery carrier), the latter carrier may not be satisfied with what would be its revenue share of a three-way division of the published single-line rate. Instead of simply accepting its pro-rata share of the single-line rate, the third-party carrier may add a mark-up to the single-line rate. This mark-up normally is the applicable freight rate applying only to the distance traveled by the third-line carrier.

In the above situation *where published single-line rates exist*, the prior long-haul carriers most often

will absorb the difference between the mark-up assessed by the third-party carrier and the amount the latter otherwise would have received under a pro-rata revenue division of the single-line rate. The shipper or receiver pays only the published single-line rate. Thus, a case could be made in such instances that there is a certain cross-subsidization of the local delivery service by the line-haul carriers. *However*, where no published single-line rate exists through to a shipment's final destination, the shipper or receiver pays both the single-line rate to the nearest published point *plus* the local service mark-up rate to the final destination. It is also in instances such as this that arbitrary rates are applied, as documented and explained in the above-cited Rocky Mountain Study. It is difficult to perceive how and where any cross-subsidy might exist in these situations.

From the perspective of carrier costs on service to small, rural towns, other questions also are raised on the extent and need for a cross-subsidy on service to rural areas. For example, the previously referenced R. L. Banks study (4) portrays ICC regular common carriers who are specialists in serving smaller, rural communities, and are reaping profits in doing so! These carriers had no network of high-density traffic corridors on which they could earn above-normal profits and use these to subsidize service to small communities. Instead, these carriers basically were profitable on small communities service alone! Such findings strongly deny the claim that rural common carrier service is inherently unprofitable, and will not exist unless it somehow is subsidized.

Additional evidence is provided by the American Trucking Association survey previously discussed. They found that thousands of firms wished to provide regular service to small towns. Rural service is self-supporting and there is no need for a cross-subsidy.

Moreover, as shown by the evidence on the common carrier obligation from the Wyoming study, there is little reason to believe that common carriers choose to use profits from high density routes to pay for service on low density routes. They are not effectively required to provide such service as a condition of certification and they certainly have no private incentive to do so.

## SHIPPER AND RECEIVER PERCEPTIONS CONCERNING MOTOR CARRIER SERVICE TO SMALL TOWNS

A last topic to be examined in the controversy on motor carrier service to small towns is the present quality of service which such towns receive under the current regulatory structure. Supporters of ICC regulation often maintain that without the common carrier obligation, small towns and communities would have no guarantee of responsive, quality truck service.

In the first part of this paper, evidence already has been cited to the effect that regulated carriers do not necessarily serve all points for which they are authorized and have a technical common carrier "obligation" to serve. It remains to be investigated, for those carriers who *do* provide service to sparse points for which they hold operating authority—but who may not specialize in such service or regard it as a particularly profitable or important part of their operation—what shipper and receiver perceptions are in regard to the quality of this service.

In the previously cited Rocky Mountain Study, a mail questionnaire was circulated by State Regulatory Commissions to rural shippers and receivers on the quality of the transportation service they receive. Responses were received and tabulated for transportation users in Utah, Wyoming, and Idaho (2, p. 60). Fifty-five percent of the respondents rated their service unfavorably. Many individual comments on truck service were volunteered. They ranged from calling the service erratic to stating that "the stagecoach would be faster." One respondent in Idaho commented that private carriage from California is $400 a trip cheaper than using common carriage.

In reviewing these comments, the study authors are led to state that "one cannot in any way conclude from the results that motor carrier freight service to small outlying communities is highly satisfactory to the users" (2, p. 60).

The two most serious problem areas spotlighted by the survey were high rates and slow deliveries. Claims problems were also a frequently raised issue. The most favorable comments on service mainly were in regard to parcel post or UPS service. Indeed, as many as one-third of the shipments involved in the survey seem to have been small and "in a hurry" shipments.

The mail questionnaire results also showed that 66 percent of the respondents used private carriage. This high incidence of private carriage usage is perhaps most indicative of the poor quality of regulated carrier service. Shippers usually switch to private carriage because of dissatisfaction with available common carrier service.

Another interesting survey regarding user perceptions of regulated truck service is a study undertaken in May 1976 by the National Federation of Independent Business (NFIB). The NFIB is an organization of nearly 450,000 members who comprise the largest cross-section of small and independent businesses throughout the United States, in rural as well as urban locations.

Federation members were asked to respond to the following three questions concerning Interstate Commerce Commission regulation of the motor carrier industry:

Question # 1—Are you for or against relaxing Interstate Commerce Commission requirements for

new or additional motor carrier service in specific towns, cities, markets or new plants?

Question # 2—Are you for or against reducing the present antitrust law exemption now enjoyed by motor carrier rate bureaus in certain anticompetitive ratemaking practices?

Question # 3—Are you for or against relaxing ICC restrictions on freight operations of private carriers and exempt agricultural carriers?

NFIB members responded in impressive numbers on this survey. A total of 60,245 votes were cast nationwide on all three of the questions.

What is remarkable about the NFIB survey response is that on both a State-by-State and a region-by-region basis, the business polled revealed a strong overall consensus in favor of regulatory reform! Returns from a sample of primarily rural States and Congressional districts were even *more* pro-reform than returns from urban areas. Particularly in regard to the need for more carriers (regulated, private, and exempt) to be allowed to serve local shippers and receivers, 70% of those responding to the survey, nationally, expressed such a need (9% had no opinion, and 21% opposed such a measure). In rural areas in North Carolina, Utah, and Wyoming, the responses in favor of *more* motor carriers to provide service reached as high as 77–78%. Such findings certainly seem to contradict the assertion that small rural business users of regulated truck transportation are currently receiving a satisfactory level of service from the regulated trucking sector.

A number of other studies also touch on the question of regulated trucking service to rural areas. For example, in a study undertaken for DOT on shipper motivations for entering into private carriage, a common motivation was to better serve a plant in a rural location (3). A selected sample of 16 firms with private carrier fleets had entered private carriage partly or wholly due to a need to provide reliable truck service to plants of theirs situated in "unfavorable" rural locations. In all of the cases studied, the firms said there was a lack of sufficiently reliable common carrier service to the rural plants. The firms involved represented a wide diversity of industrial enterprises (including industrial products, food products, chemicals, textiles, furniture, and forest products), and ranged in size from sales volumes of $5 million to over $1 billion annually. The unfavorable rural plant locations involved were widespread across the country.

## CONCLUSIONS

Proponents of the existing regulatory system have argued that without a common carrier obligation to serve small towns and rural communities, supported by implicit cross-subsidies embodied in the current structure of regulation, motor carriers would not independently provide adequate service to low-density traffic points. However, empirical documentation of this thesis has been lacking. The purpose of this paper has been to explore the validity of the claim that economic regulation of motor carriage has worked to guarantee a reasonable level of quality of trucking service to small towns and rural communities.

First, the paper explored some recent research findings on the extent to which motor common carriers adhere to their regulatory "common carrier obligation" to provide regular general freight service to small towns. The effect of these findings is to cast serious doubt on the extent to which the present regulatory system forces authorized carriers, particularly large line-haul carriers, to serve directly towns which they otherwise would not serve voluntarily. To a striking extent it seems that ICC regulated carriers have worked out their own arrangements for deciding what size towns they will provide with what level and type of service with little, if any, oversight or enforcement by the ICC of trucking firms' common carrier "obligation."

Secondly, the paper also reviewed the evidence of recent studies in regard to the claim that ICC regulated common carriers cross-subsidize service to small and rural towns. Again, these findings challenge the conventional claim. The evidence implies that many small town shippers and receivers of goods do, indeed, pay their fair share of the costs of the motor freight service which they receive. Whether this is true for the majority of small town shippers and receivers and whether they actually may pay more than their fair share of costs for the service they receive, remains to be established. In any event, there are findings which also suggest that small town service certainly can be profitable for motor carriers geared to cater to and/or specialize in such service.

The burden of proof, in the face of the existing findings, must be on the advocates of continued regulation to show how, if at all, economic regulation has benefited small towns and rural areas. Interstate Commerce Commission data on the availability, cost, and quality of trucking service to small communities is woefully sketchy, disorganized, and inadequate for establishing the actual impacts of regulation on small shippers and receivers in sparsely populated, out-of-the-way communities and locations.

Advocates of regulatory reform, on the basis of existing data and considered analysis of the nature of Interstate Commerce Commission regulation of the motor carrier industry, have come to question whether this regulation rather than assuring readily available, reasonably priced motor carrier service to small communities—may, in fact, have done much the opposite. It is our conclusion that well-intentioned but misguided economic regulatory

policies probably have done more to thwart the provision of responsive, quality general freight truck service to rural areas, than to encourage it.

Rural towns would be much better served by a regulatory program which placed greater reliance on competitive market forces, and which would eliminate unnecessary and wasteful restrictive entry provisions and motor carrier operating restrictions. A liberalized system of entry into rural markets, allowing responsible new carriers into the industry, would encourage innovation and enable well-managed smaller firms to expand as market forces dictate.

Regulatory reform which would enhance competition through liberalized entry and increased pricing flexibility for carriers would offer net benefits to shippers and receivers of all sizes and in all locations. New entry, or the threat of new entry, would encourage improved service at competitive rates. In a competitive market all rates would be cost-based. One carrier's rates could not exceed competitive costs, or it would lose its business to a competitor. This competitive discipline would force rates into a more consistent and rational pattern, and inequities which now result from an artificial rate structure would be eliminated. For small towns and sparse traffic points, the threat of new entry would enforce an important competitive discipline on service and rates, even though actual new entry might not occur.

Without hard evidence that the common carrier obligation has been an effective and efficient guarantee of motor common carrier service to small, rural towns, there is no justification for the present extent of restrictive entry and rate regulation practiced by the Interstate Commerce Commission. Until the time that the ICC can adequately inform the users of transport service which regulated carriers are authorized to serve them, and at what prices relative to the actual costs of providing efficient trucking service in rural areas, a favorable assessment of economic regulation's performance is impossible. And a case for maintaining the present system is unproven and untenable.

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# Discussion

DR. ALICE KIDDER (Transportation Institute, North Carolina A&T State University): I would like to address some questions to the earlier speakers. In preparing your models and developing the theoretical framework, do you take into account geographic differences? I am impressed with the variation in environmental conditions on a state-by-state and region-by-region basis and I don't see this coming forth in the models. Perhaps I am missing something.

DR. DAUGHETY: Yes, location characteristics associated with both market and shipper were considered in the model.

There are differences of opinion as to what sorts of parameters one should include in explaining location. While I would not want to get into a gravity model discussion at this point as opposed to some sort of disaggregate approach, we certainly did recognize that there are differences in geographic implications of where shippers are located and where they ship.

Does this answer your question?

DR. KIDDER: Yes.

MR. ROBERT FETTER (Southern Railway): Question to Dr. Cornelius. In your very comprehensive study did you get into the matter of whether or not the carrier was an agricultural co-op?

DR. CORNELIUS: No, we didn't. The identification of a carrier as such was not a part of the study. It is, however, a very valid point.

MR. DONALD F. REHL (CONRAIL): Dr. Cornelius, have you pursued the study to the point where you show what happens to rates when the previous head-haul becomes the back-haul?

In other words, when the back-haul demands additional equipment investment on the part of the trucker and a reversal of what first was the head-haul now becomes the back-haul, what, in your opinion, happens to rates on the so-called back-haul movement?

DR. CORNELIUS: The additional equipment investment I think you're talking about is, for example, the additional cost incurred to outfit a flatbed truck with sideboards so that one could haul grain. I would suspect that there exists a break-even point limiting what a trucker could do in regard to cutting rates. While this flexibility could provide a tremendous rate advantage, I'm not sure it represents a significant factor right now. I have seen some iso-

lated incidents where this has occurred, mainly in the back-hauling of grain and fruits and vegetables.

Is this what you are getting at?

MR. REHL: Yes. For example, take a trucker who is head-hauling stone in one direction and back-hauling wheat in the other and all of a sudden it becomes more profitable to haul the wheat. But to accommodate the wheat haul the trucker has to have more equipment which he doesn't really need for the stone haul, which was previously his primary movement. In our experience we have seen some escalations in the rates on what used to be back-hauls. If, as a rail carrier you are attempting to meet that competition, you are blown out of the market the next week.

DR. CORNELIUS: I don't have any figures on what that capability might be. To the extent it exists, it would provide tremendous rate incentive to undercut railroads. I don't have any figures on how much that represents.

MR. FETTER: Just to go back and elaborate a little bit on that. The type of thing that we are finding, for example, is the situation where an agricultural exempt carrier brings cotton out of the Southwest into the Carolinas charging the published rail rate. But then this same trucker turns around and gets a cheap back-haul undercutting perhaps a manufactured goods movement. The net effect is no rate advantage to the agricultural shipper. It is this type of back-haul pricing by agricultural exempt carriers that we face. I consider—and I am speaking from a special interest—that to be objectionable.

DR. CORNELIUS: I agree with you that there are a lot of instances where this is happening. However, I would point to the fact that that is a problem due to the inflexibilities imposed upon the rail system and an open market will take advantage of it. That is what you have to expect. It is a problem in Montana. They use this same thing. No railroad has hauled any livestock in Montana of any consequence for several years but livestock is still hauled at a competitive rail rate. They require that rail rates be published so that they can haul at that rate, just to use it as a ceiling.

MR. LEONARD A. POTH (University of South Dakota): This is addressed to the Northwestern group. Your statement about weighing the importance of recognizing good service versus price in the determination of modal advantage is of interest to us in South Dakota. We are about to finish all 54 of our rail line analyses and we have got questionnaires from practically every shipper in the state and a tremendously high percentage have said that they would have used rail had they had satisfactory service.

We spent considerable time during two different ICC hearings that each lasted 11 days trying to determine the definition of satisfactory service. Therefore, it is of great interest to me to understand your approach and how you are coming along in quantifying satisfactory service versus price in the choosing of a mode.

DR. INABA: Our basic approach in quantifying service is to try to get it into some form of cost. For example, in the availability issue, if an elevator is stuck, orders cars for a particular day and doesn't get the cars for, let's say, three or four days, he is stuck with all the costs of storing that grain for that extra time. This is only a component of what service would mean. The elevator's hedging operations might be affected. In addition, there are some opportunity costs that he suffers. He would use an alternative mode and get it to the market and increase his turnaround of grain in his elevator.

We tried to capture all of these different components of cost; the components of cost that are induced by differences in the service provided by the different modes. That is the basic approach we are taking. Therefore, in the end, we won't get a measure of service or a measure of quality of service but rather a conglomeration of different costs that add up to what differences in service mean.

DR. DAUGHETY: Let me just amplify on that for one second. What we are trying to look at are impacts through some costs which are direct, such as rates, and through costs which are indirect in nature. There are impacts on inventory costs for both rolling and standing inventories. Grain in a hopper car is certainly a rolling investment and is viewed as that by many people in the field. There are also direct risk assessments that we are trying to make. For many types of freight operations, there is loss and damage to a commodity and the fact that the railroads will pay for the loss and damage does not take into account the fact that that particular item is not available for delivery at the time that it was supposed to be delivered. This is reflected both in terms of eventual loss of customers for the person who is a supplier and some penalty fees that occur across time for some companies that are engaged in using a poorer service option.

We agree with you, it is a very complicated problem. If you would like to see a copy of our questionnaire, we can send you a copy of the first annual report which contains a two-page questionnaire where we tried to get at some service characteristics such as the time it took to deliver, time that the average type of shipment like this would have taken to deliver, some questions on availability of different types of modes, equipment and things of that sort.

MR. POTH: That brings up another question. Are you trying to develop a formula whereby you can compare the problems and the costs of the different modes and decide which one provides satisfactory service and which one doesn't? It leaves me a little baffled, as I say. During the ICC hearings the shippers stated that they would ship $X$-amount if they had satisfactory service and the judge, of course, trying to determine what the net results would be, questioned the definitions of satisfactory service. We have no formula; nothing has ever been derived and therefore, nothing to fall back on.

Am I understanding you correctly? You are going to develop a method of measuring two different modes against each other?

DR. DAUGHETY: As we mentioned, the Miklius-Casavant article gets into part of this question and deals with the question of what shippers perceive and what reality is. They often are two different things.

The analytical background is to try to develop formulas or equations which reflect those parts that are measurable and then to put this into what amounts to an analysis of covariance framework. This framework allows one to incorporate dummy variables to handle considerably less measurable quantities and allows the pattern of shipping responses that we are getting in our data base to give us some estimation of how these costs enter.

Yes, while there are very difficult problems with handling what amount to extremely qualitative judgments, there are statistical procedures for at least trying to ferret out initially what the impacts are.

MR. JAMES H. LAUTH (U.S. Department of Agriculture): Two questions, one for Georgia Canellos and the other for Mary Berglund.

First, to Georgia, Secretary Coleman recently indicated or stated that the entry provisions of the Administration's motor carrier regulatory reform bill may need to be further studied. Could you indicate what additional research might be needed with respect to the free entry question?

To Mary Berglund, let me ask the question and she can be thinking about it, Georgia, while you answer. With respect to the impact on agricultural commodities of peak demand pricing, whether it be through per diem rates or whether it be through tariff changes, a commodity like fresh fruits and vegetables, whose demand is very difficult to shift because of the perishability of the commodity, or even a commodity like grain where additional storage would need to be built in order to shift demand, what chance is there that these additional costs associated with storage might offset any reduced cost of transportation during a valley period. Could you comment on that?

MS. CANELLOS: DOT's concern throughout has been trying to write reform legislation; we never had proposed free entry. Section 8 of the Motor Carrier Reform Act is the entry provision. We struggled for some time with the transitional problem of going from a very tightly regulated system to loosening things up, but not free entry tomorrow. We recognized that people have made investments and decisions on service and locations, and we never conceived that we were going to propose free entry. It was just unrealistic and it would be an unfair transition.

I think that the Motor Carrier Reform Act was the first shot at saying, OK, we have been doing a lot of talking about motor carrier reform, let's draft something up and put it out and see what kind of comments people have, where the problems are, get some alternative suggestions. We don't have the final answers. I don't know what eventually is going to come forth as far as the entry provision that will eventually get passed in the Motor Carrier Reform Act of 1977 or 1978—I will be more optimistic and say 1977.

If anybody has any alternatives or different ideas, we would appreciate hearing about them. What we basically proposed in our entry reform section is that entry has to be changed so that new applicants would no longer have to prove a need for the service and prove public convenience and necessity. They would still be required, however, as under the existing statute, to prove themselves fit, willing and able. In addition, carriers who were competitors to them could not come in as protestants. The applicant would be required to show compensatory rates based on the cost for the service that he was providing.

Now this may not be sufficient. There may be other ways to do it and there are many ways to ease up entry and we are still looking for the right one.

DR. BERGLUND: The question was in regard to whether we thought that storage costs would offset any rate decrease advantages as a result of demand pricing.

To begin with, products will have to be stored whether at origin or at destination sometime or another. This is a matter that does need some investigation and therefore, we are not totally sure whether this type of demand can, in fact, be shifted. With this type of market pricing we had to estimate an upper or lower range of savings assuming the demand could be shifted and that there would be no change in demand. Furthermore, we assumed that the railroads would keep the existing car fleet and yet the off-peak rates would compensate them to some extent. In other words, they would be realizing some return from storage.

I am not sure whether that answers what you were speaking to or not.

MR. LAUTH: I think it partially does. As you know the Quad-R Act has in it a provision for peak demand rates. I think our concern is that for some agricultural commodities where it is not possible to shift demand from one period to another, either not possible because the commodity cannot be stored, as in the case of lettuce, which following harvest, has to be shipped as fresh lettuce, or where additional storage would have to be built as in the case of grain, that these storage impacts may be more costly than the offsetting reduction in transportation rates. The net result is that a blanket peak demand pricing would not be advantageous to agriculture. Even with respect to the storage of grain, the farmer may not benefit, at least in the short run, because the elevator operator who buys the grain will more than likely have to charge the higher peak period rate to hedge

himself against the possibility that he may have to sell and transport the grain during a peak demand high rate period. Consequently, the producer won't get the benefit of a reduced transportation cost. In the longer run I suppose he might get the benefit of the availability of more transportation; if it works out that way.

DR. BERGLUND: This is one problem which the research did not address. We did not look into the distributional aspects when we estimated those losses to the railroads. If rail rates were reduced, would they pass the savings on? This is a big issue, and how you answer those distributional questions, well, is anybody's guess.

MR. LAUTH: I guess what I am suggesting is that this may be an area for additional research.

DR. BERGLUND: Right.

MR. REHL: This one is for Dr. Berglund. I was entranced with your idea of a sale of hopper cars for grain. I think a few years ago we had some bidding on some private hopper cars that got us in a little trouble, namely Ex Parte 307.

I am wondering, under your proposal, when would these cars be available if the shipper decided to bid on a quantity of cars? That is, would they be at the destination end or would they be returned back to origin country, for example, East Coast versus Midwest or wherever the cars were to be loaded?

DR. BERGLUND: I don't want to get too much into the mechanics of the auction. Basically, it would work over an auction tape in a national market. For example, suppose you have a thousand cars in Baltimore, 2,000 in New York, 500 in New Orleans, etc. These are all options to the shipper and he would make some kind of a cost-benefit analysis based on the amount of empty mileage he would have to pay from where they were empty to where he wanted to load them.

**Discussions in all sessions were amplified and recorded**

# Session C: People, Commodity, and Service Transport in Rural America

Dr. Alice E. Kidder, *Moderator*
Acting Director, Transportation Institute
North Carolina A&T State University

## OVERVIEW OF SESSION

Transportation, as economists have looked at it in the economic development context, has not been clearly shown to make a difference in the aggregate for a multi-regional economy. The region that gets the facilities may get an advantage at the expense of another area which does not, and so the public policy decision to provide transportation facilities may not seem to be as crucial as deciding how to allocate them. We are concerned in this session with the allocation of those opportunities, and I don't think we should apologize for this concern.

Another overview point is that often transportation policy for one region is historically rooted in decisions made about transportation for another region or for another set of issues. For example, it would appear to me that transportation policy vis-a-vis passenger transportation in rural areas is often flavored by decisions that have been made vis-a-vis passenger transportation allocation decisions for the urban areas. The reverse may be true with respect to freight; that is, the decisions to promote rural development through freight decisions may be dominating certain concern apropos of urban choice today. Thus, equity concerns can lead to more investment than economic efficiency requires.

A third element in our overview must be a look at the allocation of expertise on transportation issues between urban and rural areas. The very fact that universities tend to flourish in major metropolitan areas and that many of the prominent researchers in the field of transportation come from urban rather than rural backgrounds may affect the choice of topics for research and the approaches.

We are fortunate that the group of people that have been assembled today have a great deal of sensitivity and feel for the concerns, interests, and needs of rural areas. I think that what you will see in the papers is a challenge to the basic tenets of micro-economic analysis and an avowed concern for the transportation disadvantaged or development questions that lie beyond the narrow framework of micro-economic analysis.

This session provides us with an opportunity for a healthy interaction between two groups of individuals—the transportation planners that have been interested in implementation of policy, and persons who come out of the agricultural research tradition, where extension activities include the linkage between new concept developments and direct inputs into the production process in rural areas. I hope that we will have a successful interchange between these groups of people.

One of the problems that we find in rural areas is the question of which city shall be promoted to the disadvantage of other cities and which ones will get the grants, and which ones will not. In the case of metropolitan areas there is usually one principal city, in an area that you can be virtually assured will have centralized decision making on transport facilities, and these can seek a single grant. The individual rural areas on the other hand, do not know if they will be successful in grants competition, and the cost of applying may result in all areas abstaining.

Finally, one piece of information that is very crucial for researchers to inquire about is, "what about those applications in rural areas that failed?" For example, we have had a major round of competitions apropos the 147 rural transit demonstration grants. Those applications often have been successful or turned down based on the quality of the expertise, the thinking process, political considerations and other factors. Those of you who are from universities in the areas might well ask the questions, which of the projects receiving grants succeeded and which ones failed and why, and can the expertise here assembled improve the planning process so that we do in fact implement the concepts that will be presented in this session.

Alice Kidder moderated Session C

# Transportation and Rural Development: Some Policy Considerations

Richard K. Hart*
Professor of Economics and Director of Research,
Grants, and Contracts, Boise State University

Rural development is often spoken of in romantic terms, as if by reversing the migration trend it would be possible for a larger percentage of the population to enjoy the amenities of the countryside. While this may be true in part, what rural development and population redistribution really imply, of course, is spreading around both the economic, social and cultural benefits of urbanization *and* the social and economic *problems* associated with same.

When urbanization comes to rural areas, a different mix of community problems is generated than these areas previously experienced. Increased pressure is exerted on natural resources and recreational facilities. The social infrastructure, including transportation facilities, must be extended and life styles changed.

This is not to say rural development should not take place; on the contrary, rural development *must* take place, but it should also be recognized that the country life is not being offered to the millions who will eventually live in presently disadvantaged regions. The mountain, so to speak, is brought to Mohammed so that Mohammed *won't* go to the mountain.

In attempting to stimulate rural development, some basic economic considerations may have been overlooked. To quote Maddox:

> If the difficulty stems primarily from the fact that industrial and business investments can earn higher rates of return in urban areas than in rural areas, the proper corrective actions may be to raise the education and skill levels of rural workers, to improve transportation routes and power supplies, and to take other steps which are aimed primarily at enchancing the productivity of private capital in rural areas. (8, p. 21)

With respect to Maddox's contention that improved regional productivity should set the stage for rural development, his thesis agrees with the recommendations of the President's Task Force on Rural Development. The Task Force recommended in 1970 that, among other things,

> . . . the Federal Highway Act be amended to provide for a classification in the Federal-State highway system to be designated "rural development highways." These new short-mileage highways should lead to existing highways, thereby serving local areas that have a high development potential (10, p. 45).

And,

> The Task Force recommends that the President request the Interstate Commerce Commission to scrutinize all aspects of the rate structure of public carriers to serve the new national policies in rural growth and development (10, p. 46).

Other recommendations to the Task Force include reliance on private capital to finance rural development projects supplemented by government aid to disadvantaged regions in education, nutrition, welfare, and housing. Further, the recognition that the more endowed regions have the best chance of successful development and that communities with locational and size advantages should serve as "growth centers," is implicit in the report.

A different presidential task force also emphasized the necessity of population redistribution and recommended that the nation establish a population dispersal policy "for long-term economic progress" (9, Ch. II).

The concept of growth centers in the central role of rural development is consistent with the decentralization of rural population now taking place concurrently with the centralization of markets and other economic activity (13). Emphasizing this trend will require improvements of the transportation infrastructure, primarily highways, to facilitate growth and the linking of communities.

It is not the purpose of this paper to examine in depth the rural development history or the evolution of policy considerations in the country (3). Great progress has been made in the past few years. The efforts of the U.S. Department of Commerce and the U.S. Department of Agriculture, especially in the past twenty-five years, have done a great deal to revitalize the depressed areas of the Nation. Much remains to be done. The Rural Development Act of 1972 was a most important step in the right direction.

This paper will explore briefly some of the ramifications of rural development with respect to the nation's transportation system and policy. Clearly the rationale for rural development implicates most directly those who set policy and priorities with respect to transportation regulation and budgets.

*Editor's note: This paper was orally presented by Dr. John Mitchell of Boise State University.

If rural development is to proceed in an orderly and efficient manner, adequate performance of the transportation infrastructure and regulatory structure is mandatory. Highway, water, rail, and air transportation investments should be closely coordinated with those state and federal agencies directing the various rural development programs. The Secretary of Agriculture, with new expanded administrative responsibilities in rural development, along with the Secretaries of Commerce and Transportation, especially bear substantial responsibility for coordinating efforts in this endeavor.

An investigation of the comparative advantages of localities in the production and distribution of products, and the development of service industries at once reveals the importance of the transportation factor.[1] Accepted theory tells us that any firm attempting to minimize costs (maximize profitability) will attempt to locate such that the costs of transporting inputs and the production and distribution of final products will be minimal. Because changes in both regulation and effective technology may affect rates (transportation costs), these three elements are considered here in trio.

A simple illustration of comparative advantage, often used in transportation texts, sets forth an hypothetical example where two localities, A and B, are in a position to serve the market for a particular good in location C. If production costs are equal in A and B but transportation charges are not equal, the locality with the lowest transportation costs will have the comparative advantage in market C. Should production costs be higher in one place than the other, the disadvantage of the higher cost area can be neutralized or overcome by lower transportation rates. Where differentials exist in both production and distribution expenses, the comparative sums of the two costs in the competing localities will determine which place shall prevail in the market.

Should imperfect competition exist in one of these hypothetical industries, "economic profits" may allow the disadvantaged locality to produce, but returns on investment will be lower and perhaps even marginal. If other production possibilities are not optional for the area, production of the good will take place as long as "normal profits" are obtainable. In this case, the producing region is said to be specializing in the production of a good wherein it has the least comparative disadvantage. All of this, of course, is review.

Private firms in the business of transporting goods have historically been well aware of the role of transportation costs in industrial development and economic activity. Those firms which are regional in nature have often promoted economic development in their respective service areas through rate incentives and/or technological innovations.

Sampson has found, for example, that certain forestry and agricultural products shipped by rail to eastern markets from the states of Oregon and Washington enjoyed favorable rates as of 1961 (11). Competition from the South in forestry products was especially influential in the establishment of rate zones blanketing the Northeast.

Daggett and Carter found a similar situation with regard to certain agricultural commodities shipped to the Northeast from California in competition with Florida produce (5). Other studies show that given the commodity mix of exports from, and imports to, the Plains states, the region contributes more to rail overhead expense than the national average (6). The New England Region seems to be favored with nondiscriminatory rates on manufactured goods (7, pp. 75-76).

It appears that the rails which are regionally oriented have been instrumental in establishing rate structures which did not necessarily reflect costs of service, but which have worked both for and against regional comparative advantage.[2] The extent to which resources have been inefficiently allocated because of these well-established rate structures is unknown. Certainly if future changes in the rate structure occur which bring about rates more closely aligned with costs, there will be some regional shifts in production.

Changes in technology can lower rates, increase speed of delivery, reduce damage losses, and in other ways affect the costs of transport. Although it may appear, superficially, that the aforementioned factors, other than rates, are non-cost factors, in reality, of course, they become capitalized into the cost of doing business. Loss due to damage, for example, means that the cost of transportation is actually higher than it would be if damage claims were not capitalized into the published tariffs.

The Big John hopper cars put into service by the Southern Railroad reduced rates on wheat from the Plains States to the South. A partial shift in location of the milling industry followed. "Piggyback" or Trailer-on-Flat Car (TOFC) is another important innovation, as are specialized rail cars with greater capacities and lower damage loss rates. Many other current and discussed innovations on the part of the railroads, which reduce high terminal costs and aid in the rails becoming a more competitive mode, or in facilitating intermodal carriage, also have the possibility of lowering transportation charges in general.

Changes in trucking technology emphasizing the short haul have not been so dramatic. To the extent that the trucking industry is not able to offset decreasing terminal costs of railroads and waterways through decreased line haul rates, the trend toward trucking by industry may slow. Current uncertainty regarding fuel costs and availability, rail rationalization, future technological changes in both transportation and manufacturing, and future policy decisions that implicate transportation in the efforts to redistribute populations, makes the prediction of future industrial location trends uncertain.

To a lesser extent than rail, improvements in the

technology of water transport may also reduce long haul costs and thus affect the location of growth. More particularly, barge/rail or barge/truck transportation may become increasingly important in the future as the technology to facilitate more convenient intermodal transfers is developed.

Should rates decline in the future and/or the trend continue of transportation costs declining as a percentage of total selling price, transportation will be less important as a determinant of industrial location. Other factors in regional endowments will then exert an even greater pull on economic activity. Locations of raw materials may be overlooked as processing sites, however, as lower freight rates emphasize the long haul.

Increased capacity in the transportation sector wrought by technological change, facility improvement or extension of the system may have different effects among regions, depending on the endowments of differing locales. Wilson cites the trichotomy of positive influences, negative influences, and a "middle case" (16, pp. 46–50).

In the positive instances, expanded production is made possible in those (presumably more endowed) regions when transport capacity is expanded. Better linkages to other regions reduce resources required for production and distribution of goods and the movement of people, enhancing both economic efficiency and comparative advantage.

The middle case is where investment in transportation capacity is near optimal, and continued expansion may result in excess capacity and diminished efficiency. The negative case involves the dominance of the "backwash" effect over the "spread" effect. In the latter, expansion of production in one region raises the income level and the demand for goods from other regions. In the former, expansion is competitive with other regions and may siphon off resources formerly used elsewhere and thus not contribute to overall growth.

These issues raise substantial questions for policy makers and for those interested in regional growth who may feel that transportation is fundamental in aiding rural development. Perhaps the most important step before taking action to stimulate the growth of a particular area is to properly assess the relative position of the region in question on the continuum suggested by Wilson (16).

Transportation investments tend to be of the long-term variety and once committed, resources have few, if any, alternative uses. The role of technology in increasing capacity of the transportation system warrants careful study for potential locational effects. Transportation effected locational shifts may run counter to other policy goals. Before long-term investment is made regionally, these cause and effect relationships should be known insofar as time and resource constraints allow.

Policy considerations in transportation and rural development are addressed elsewhere in this paper. That aspect of policy which is lightly treated here bears on changes in the transportation system which result from policy decisions and not as a result of economic interactions.

Federal monies have been extensively channeled into various programs for both transportation and rural development (1 and 2). It is likely that extensive capital outlays will continue to be made in both areas. The transportation problems facing the nation currently are considered by some to be primarily urban; mass transit systems for densely populated urban centers and surrounding fringe areas continue as high priority under present DOT policy.

Now that the interstate highway system is largely completed, attention should necessarily focus on other primary roads and the secondary feeder systems serving these regional connecting routes. The condition of these roads and necessary or recommended expenditures for the highway system is not the focus here, but rather the economic impact on rural development of highway and unsurfaced road improvement.[3]

The question should be asked, what would be the optimal transportation system for the United States, and what changes should be made in the present system to reach optimality? Though the full answer is not now available, parts of the solution are apparent.

Motor vehicles have become increasingly important in the movement of goods in rural areas. The trend is very likely to continue. Rail abandonment in some rural areas will hasten the centralization of market activity and population in such regions. The aggregation of grain elevators, machinery distributors, and feed, seed, fertilizer, and chemical vendors to larger rural communities will place additional stress on the secondary road system.

It should be noted that such centralization is produced in part by economies of scale accentuated by rising costs in all these marketing and production links. Farms are also becoming larger and the farm population smaller for the same reason. Policies which will facilitate this natural economic adjustment seems the proper course of action.

Improved secondary roads will allow heavier loads and faster service, both of which have a tendency to lower costs, or prevent them from rising as fast as they otherwise would. Centralization of market services also means lower transportation costs and better service. As the secondary road system improves, there is a tendency for rural population to stabilize. The labor pool is essentially expanded in more urbanized rural communities as decreased travel time allows people farther away to commute to work. This seems to be a major factor in the location of business firms in rural areas.

As the population becomes more stable, there is a better probability of a "spread effect" beginning by which outlying communities also begin to experience growth. It must be recognized, however, that this

simply is not going to occur in all instances. Many rural communities will continue to decline despite (or perhaps because of) improved roads linking them to larger communities.

There is a tendency by some to attach too much importance to transportation in the development process. Other factors, in many instances, are overriding in the causal equation. This should be well understood by policy makers at all levels of government when highway priorities are established. It seems rational to spend highway funds where the potential marginal benefits are the greatest (4). If the decision is an element in rural development policy, as it should be, then those areas where the benefits to the total economy per dollar spent are the highest should receive top priority.

Regional Commissions and/or states are probably in the best position to make such decisions. The result should be a better allocation of resources since the more endowed regions will initially benefit most. But other regions and states which export to or import from the benefiting area will realize lower priced goods than otherwise through lower transportation costs and perhaps reduced production costs as well.

Prior to a major program of refurbishing the nation's highways should be a critical examination of transportation regulation. Barriers to entry in the trucking industry and regulation which retards competitive performance should be stricken. In this way, regional comparative advantage will be enhanced. Investment decisions will then be easier to make, based on economic efficiency to be gained.

With respect to rail transportation, the inherent advantages of this mode should be recognized as well as the changing nature of the demand for transportation. Decreased importance of the long haul should be understood. Some rationalization must take place and better systems of collection for such hauls need to be developed. Again, this will require economic adjustments in location and distribution patterns. Some of these adjustments will be locally painful.

Wholesale abandonment of lines, however, should not occur until development of an economically feasible alternative is explored. In at least some cases, changes of ownership and restructuring of low density lines into short lines may revitalize both the line and the area it services. In other cases, the economic activity served by the lines originally has declined or changed in nature, rendering the lines uneconomical. In the latter instances, orderly abandonment may be the answer; in the former cases, earlier investments may be enhanced and made profitable. In any case, it should be understood that abandonment has an aura of finality associated with it, and possible future needs should be considered in the decision.

Barge transportation is, of course, limited to navigable (or potentially navigable) waterways. The regions which they serve are obviously limited by geography. Nevertheless, the role which barges play in the overall transportation network must be assessed and the same criteria applied in investment decisions. Public costs of waterway improvements should only be incurred if they are likely to result in net efficiency to the economy. As in the case of rail and truck transport, there is no advantage to the stimulation of regional growth if internal subsidy merely causes a relocation of industry and population at the expense of other regions.

Air service and pipelines are not unimportant in rural development, but much less so than the three principal modes. They are given only lip service here because of the overriding problems and potentials of truck, rail, and barge transport in the development process. In the future, air transportation of goods and people may become more important. In the case of some light manufacturing and service industries, air service has become crucial in locational decisions. It is intuitive, though, that because of the relatively long distance and speed advantages enjoyed by planes, the future role which they are likely to play in the movement of goods and people, will, in general, be urban rather than rural oriented.

To summarize, policy decisions which directly or indirectly affect the costs of transportation will have locational effects in the economy. The initial step to a more efficient system and the accentuating of regional comparative advantages is the restructuring of regulation to allow transportation to become more competitive. When rate structures have changed as a result, investment decisions affecting the various modes should be made on the basis of net efficiency within the economy. Economic impact studies are more useful before rather than after the fact.

Regions which would contribute most to overall efficiency per dollar invested should receive highest priority in investment considerations. The effects of subsidy in whatever form, should be well assessed before capital improvements are made or the transportation infrastructure extended.

## FOOTNOTES

[1]See (7). This publication is "a state-of-the-art report of both the theoretical and empirical work that has been done" in the field of transportation and regional economic development. Selected references found in the bibliography were reviewed and used in this section.

[2]For a review and analysis of basic geographic concepts relating transportation to other social and economic considerations, see (12).

[3]For regional benefits accruing from the construction of the interstate highway system through a) lower cost transportation, and b) stimulation of local economies, see (14). This study, however, makes no attempt to estimate shifts in location of production due to highway construction. For a synopsis of more than 200 recent highway impact studies, with abstracts from 76, see (15).

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# Private Motor Vehicles—Rural America's Pervasive Transportation Mode

Erhardt O. Rupprecht
Agricultural Economist, Economic Research Service
U.S. Department of Agriculture

The demand for personal transportation services arises for basically the same reasons in both rural and urban areas. Indeed, the transportation of people serves important functions in both the production and the consumption process. In the production process, it enables workers to commute to jobs or to places selling needed production inputs; in the consumption process, it allows individuals to participate in goods and services markets as well as "consume" such intangibles as recreation and social interaction with others. The growth of remote communication and delivery of services can reduce mobility needs, but it is unlikely to quench desires for mobility.

To meet travel needs, an individual can, theoretically, purchase transportation services in either or both of two forms—private or for-hire. For example, he can purchase or lease the capital equipment, in this case a motor vehicle, which he operates to provide transportation services as needed. He may also have the option of hiring transportation services on a trip basis either from public carriers or perhaps a neighbor.

Approximately one-quarter of the U.S. population resides in rural areas; or using the Standard Metropolitan Statistical Area definition, almost a third of the population lives in non-metropolitan areas (6). These people need transportation if they wish to participate in many economic and social activities. In many, if not most, rural areas a wide range of alternative transportation services are simply not available at the local level, in part because rural America has come to depend primarily on the private motor vehicle to meet its personal mobility needs and in part because people in rural America have always provided much of their own transportation needs. Public forms of transportation for rural people could be wasteful and fruitless at least in the near future. It could be fruitless because people in rural areas by preference, or of necessity, rely on private forms of personal mobility. It could be waste-

ful because, even in the face of potential energy "crunches" and overall increases in the cost of motor vehicle operation, private transportation could continue to be more economical in rural areas.

In this paper, I will present some comparisons among the various regions of the country as to vehicle accessibility and travel characteristics. I will then examine some of the reasons for and the extent of this preference for private motor vehicles by nonmetropolitan residents and farmers. In addition, I will explore some of the implications of this reliance on motor vehicles.

## ACCESS TO AUTOMOBILES AND TRUCKS

The term "private motor vehicles" as used in this paper includes both automobiles and trucks, particularly light trucks such as pickups. According to the 1972 Census of Transportation, just over 65 percent of the trucks used in agriculture are pickups (5). Rural people, especially farmers, use light trucks for both passenger and freight transportation. Ignoring trucks as an element of people transportation would be a serious omission in this analysis.

Data on access to motor vehicles are available from several sources. Summaries of The 1974 Annual Housing Survey contain data on automobiles and light trucks available to occupied housing units in various regions of the country. These data however are not adequate for measuring the magnitude of total access to private vehicles. That is, one can determine access to either autos or light trucks but not access to either or both in combination.

*Automobiles*.—Over 80 percent of the 71 million SMSA and non-SMSA occupied housing units in the U.S. had access in 1974 to at least one car (Table 1).

Eighty-five percent of the housing units located in non-metropolitan areas had access to an automobile. The South had the smallest percentage of housing units reporting access to an automobile. Some individuals without access to automobiles may have relied on available trucks for passenger mobility.

One finds that automobile access in central cities differed markedly from suburban areas. For example, just under three-quarters of the SMSA central city housing units reported access to an auto, while suburban housing units reported that 90 percent had access to a vehicle (Table 1). This high percentage of accessibility to a car on the part of suburban housing units is probably a function of their affluence and their need for vehicles in the dispersed pattern of development that exists in some of these areas. Almost 40 percent of suburban housing units had access to more than one car (7).

The percentage of housing units with access to an auto was remarkably similar for the central cities and outside SMSA areas of the South and West. Central city housing units were more oriented toward autos in these regions than in the North Central and particularly the Northeast regions.

*Trucks*.—The more pervasive access of SMSA-noncentral city housing units to automobiles as compared to access of non-SMSA housing units as shown in Table 1 may be offset by greater access to trucks of non-SMSA housing units. The Housing Survey also collected data on access to light trucks, i.e., pickups and panel trucks with a one-ton capacity or less. In order to be included in the data, the trucks had to be reported as used for some personal trips by the household.

While only 20 percent of the occupied housing units in the U.S. had access in 1974 to light trucks, they were definitely more prevalent in non-metro areas (Table 2). For example, one-third of the housing units in non-metro areas reported that they had access to at least one or more light trucks. In the West, the proportion was 45 percent. Housing units in SMSA's of the West and South also reported substantial access to light trucks. These data do not permit an evaluation of the degree of access to private vehicles in different types of areas, but they are consistent with the notion that access for rural households may be equal to or greater than for urban households.

## FARM HOUSEHOLD USE OF AND ACCESS TO MOTOR VEHICLES

The data presented above focused on availability of motor vehicles for persons in occupied housing units in SMSA's and non-SMSA's. A 1975 Farm Production Expenditure Survey obtained this type of information for farm households. The survey covered over 5,600 farms in the U.S. These unpublished data allow a greater insight into rural travel characteristics. For example, it determined the annual mileage that farm households incurred for such trips as shopping, medical care, etc. At present, tabulations of these data are only available for farm households aggregated by farm production regions (see 10), but soon we hope to analyze the survey responses in greater depth.

*Automobiles*.—Farm households on the average had 1.2 automobiles on hand per farm (Table 3). The farm production regions in the southern part of the country tended to have fewer autos per farm available. Most of the automobiles available to farmers were predominantly intermediate and full-sized, a fact that has some significant implications for energy conservation.

Autos on farms were important in family use trips such as shopping, recreation, etc. For example, farms in the Appalachian, Southeast, Delta, Southern Plains and Pacific farm production regions incurred approximately 65 to 70 percent of their au-

Table 1. Percentage of occupied housing units with access to automobiles, by region and type of community, 1974

| With access to:[1] | Regions | | | | U.S. |
|---|---|---|---|---|---|
| | Northeast | South | North Central | West | |
| | | | Outside SMSA | | |
| At least 1 auto | 86 | 82 | 88 | 87 | 85 |
| None | 13 | 18 | 12 | 13 | 15 |
| Total | 100 | 100 | 100 | 100 | 100 |
| | | | SMSA: central city | | |
| At least 1 auto | 56 | 80 | 75 | 82 | 73 |
| None | 44 | 20 | 25 | 18 | 27 |
| Total | 100 | 100 | 100 | 100 | 100 |
| | | | SMSA: non-central city | | |
| At least 1 auto | 89 | 90 | 93 | 89 | 90 |
| None | 11 | 10 | 7 | 11 | 10 |
| Total | 100 | 100 | 100 | 100 | 100 |
| | | | SMSA and non-SMSA | | |
| At least 1 auto | 76 | 84 | 86 | 86 | 83 |
| None | 24 | 16 | 14 | 14 | 17 |
| Total | 100 | 100 | 100 | 100 | 100 |

[1] Statistics on automobiles included station wagons, which were owned or regularly used by any member of the household and which were ordinarily kept at home. These figures also included leased automobiles, taxicabs, and company-owned automobiles kept at home.

Source: U.S. Bureau of the Census. Current Housing Reports, Advance Report H-150-74, Annual Housing Survey: 1974, Part A, General Housing Characteristics for the United States and Regions. U.S. Govt. Printing Office., Washington, D.C., 1976.

tomobile mileage for these trips, while in the rest of the regions such trips accounted for slightly over 50 percent of annual mileage for this purpose.

Mileage on farm business trips accounted for 24 percent of the annual auto mileage. However, farms in the Northern Plains, where distances to major trading areas are great, incurred almost 40 percent of their automobile mileage on farm business. Many of these miles may have served subsidiary trip purposes simultaneously. For the Appalachian, Southeast, and Delta regions, on the other hand, farm business trips accounted for less than 20 percent of their annual auto mileage. Other nonfarm business accounted for between 10 and 20 percent of the auto mileage with the exception of the Northern Plains with only 8 percent and the Delta region with 30 percent. Perhaps the opportunities for other than farm work by farm household members are greater in the one region than the other, but analysis of the influence of such relationships remains to be done.

Farmers in the southern regions averaged auto mileages of less than 10,000 miles due perhaps to the lower automobiles-per-farm figure and/or the higher density of trading centers thereby requiring shorter trips for southern farm people. Other regions averaged between 12,000 and 16,000 miles per farm.

*Trucks*.—As mentioned earlier, many farmers use light trucks to transport farm inputs and outputs as well as for family purposes. Farms in the various production regions on the average had between 0.8 and 2.9 trucks on hand (Table 4). Indeed, the Northern Plains, Delta, Southern Plains, Mountain, and Pacific farm production regions actually had a higher average number of trucks per farm than of automobiles (Tables 3 and 4).

As expected, most of the farm truck mileage was accumulated on farm business trips. All of the production regions except the Delta, Appalachian and Corn Belt regions incurred at least 70 percent or

Table 2. Percentage of occupied housing units with access to light trucks, by region and type of community, 1974

| With access to:[1] | Regions | | | | U.S. |
|---|---|---|---|---|---|
| | Northeast | South | North Central | West | |
| | | | Non-SMSA | | |
| At least 1 truck | 20 | 34 | 32 | 45 | 33 |
| None | 80 | 66 | 68 | 55 | 67 |
| Total | 100 | 100 | 100 | 100 | 100 |
| | | | SMSA | | |
| At least 1 truck | 7 | 18 | 13 | 21 | 14 |
| None | 93 | 82 | 87 | 79 | 86 |
| Total | 100 | 100 | 100 | 100 | 100 |
| | | | SMSA and Non-SMSA | | |
| At least 1 truck | 10 | 25 | 20 | 26 | 20 |
| None | 90 | 75 | 80 | 74 | 80 |
| Total | 100 | 100 | 100 | 100 | 100 |

[1]Statistics on trucks, pickups and small panel trucks of one-ton capacity or less which were owned or regularly ued by any member of the household and which were ordinarily kept at home. Trucks used for business purposes were included only if also used for personal activities of household members.

Source: U.S. Bureau of the Census. Current Housing Reports, Advance Report H-15-74, Annual Housing Survey: 1974, Part A, General Housing Characteristics for the United States and Regions. U.S. Govt. Print. Office, Wash., D.C., 1976.

more of their mileage on farm business (Table 4). Truck miles used for family use accounted for between 10 and 15 percent of the total truck miles in most of the farm regions. The farms in the Northern Plains region, though incurred only 6 percent of the truck miles for family use while those in the Pacific and Appalachian regions devoted 17 and 18 percent of their truck miles, respectively, to this purpose.

The average number of truck miles per farm varied from approximately 7,000 miles in the Appalachian region to over 21,000 miles in the Mountain region. The higher mileages tended to be a function of the higher average number of trucks per farm. However, the Southern Plains did not seem to follow this pattern since the few trucks had relatively large total mileages per farm.

Most of the trucks were pickup trucks and pickups accounted for most of the mileage (Table 5). The percentage of pickup trucks varied between 56 and 80 percent of all trucks. The smallest percentage of pickup trucks occurred in the Northern Plains region. With the exception of the Northeast and the Northern Plains, 80 percent or more of the total truck miles were due to travel by pickup trucks; in the Southern Plains, they accounted for over 90 percent of the truck miles.

*Overall Access to Private Vehicles*.—By combining data for autos and trucks on such characteristics as vehicle availability, total mileage per farm and mileage by purpose, a better perspective on travel differences among the farm production regions is possible. For example, the larger number of available vehicles per farm tended to result in more miles of travel per year. The Mountain and Pacific farm production regions had more vehicles available on the average, while the Appalachian, Southeast, Delta, and Southern Plains farms had fewer (Table 6). Farm households in the Mountain and Pacific regions drove over 30,000 annual vehicle miles while the Appalachian and Southeast regions averaged about 15,000 vehicle miles. Farm households in the other regions had total annual mileages of approximately 20,000–26,000 miles.

Combined mileage data according to purpose reveals that, with the exception of the Northern Plains and the Mountain States, 40–50 percent of the total vehicle mileage was incurred on farm business trips (Table 6). Family use trips accounted for approximately 35–40 percent of the mileage except in the Appalachian, Northern Plains and Mountain regions. The latter two regions incurred the largest proportion of total mileage in farm business trips.

Table 3. Average number of autos available per farm, average total auto miles, and percentage of automobile miles by purpose, by farm production region and U.S., total, 1975

| Item | Farm production region | | | | | | | | | | U.S. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | North-east | Lake | Corn Belt | Northern Plains | Appalachian | South-east | Delta | Southern Plains | Moun-tain | Pacific | |
| | Average per farm | | | | | | | | | | |
| Autos available | 1.6 | 1.7 | 1.4 | 1.3 | 0.9 | 0.8 | 0.8 | 0.8 | 1.6 | 1.8 | 1.2 |
| Auto miles during year | 14,790 | 15,806 | 14,622 | 12,784 | 8,304 | 8,813 | 9,360 | 9,766 | 15,195 | 16,281 | 12,269 |
| | Percent | | | | | | | | | | |
| Auto miles used for: | | | | | | | | | | | |
| Farm business | 27 | 29 | 23 | 39 | 16 | 16 | 13 | 20 | 29 | 23 | 24 |
| Family use | 58 | 52 | 61 | 53 | 68 | 64 | 69 | 69 | 53 | 65 | 60 |
| Nonfarm business | 15 | 19 | 16 | 8 | 16 | 20 | 30 | 11 | 18 | 12 | 16 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: Unpublished data from 1975 Farm Production Expenditures Survey conducted jointly by the Economic Research Service and Statistical Reporting Service of the U.S. Department of Agriculture.



Table 4. Average number of trucks available per farm, average total truck miles and percentage of truck miles by purpose, for farm production regions and U.S. total, 1975

| Item | Farm production region | | | | | | | | | | U.S. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | North east | Lake | Corn Belt | Northern Plains | Appalachian | South-east | Delta | Southern Plains | Mountain | Pacific | |
| | Average per farm | | | | | | | | | | |
| Trucks available | 1.5 | 1.5 | 1.3 | 2.0 | 0.9 | 0.8 | 1.1 | 1.2 | 2.9 | 2.4 | 1.4 |
| Truck miles during year | 9,820 | 9,830 | 9,800 | 12,177 | 7,003 | 7,611 | 10,982 | 13,170 | 21,500 | 16,487 | 10,606 |
| | Percentage | | | | | | | | | | |
| Truck miles used for: | | | | | | | | | | | |
| Farm business | 73 | 70 | 69 | 88 | 67 | 73 | 64 | 73 | 76 | 71 | 72 |
| Family use | 14 | 12 | 12 | 6 | 18 | 14 | 14 | 13 | 13 | 17 | 13 |
| Nonfarm business | 13 | 18 | 19 | 6 | 15 | 13 | 22 | 14 | 11 | 12 | 15 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: Unpublished data from 1975 Farm Production Expenditures Survey conducted jointly by the Economic Research Service and Statistical Reporting Service of the U.S. Department of Agriculture.

Table 5. Percentage of trucks by type and vehicle miles by truck type for farm production regions and U.S., 1975

| | Region | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | North-east | Lake | Corn Belt | Northern Plains | Appalachian | South-east | Delta | Southern Plains | Mountain | Pacific | U.S. |
| | Percentage | | | | | | | | | | |
| Trucks: | | | | | | | | | | | |
| Pickups | 59 | 71 | 71 | 56 | 74 | 79 | 75 | 80 | 65 | 68 | 69 |
| 1-2½ ton trucks | 31 | 28 | 28 | 30 | 26 | 19 | 23 | 10 | 31 | 29 | 27 |
| Over 2½ ton trucks | 10 | 1 | 2 | 14 | [1] | 2 | 2 | 1 | 4 | 3 | 4 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | Percentage | | | | | | | | | | |
| Truck Miles: | | | | | | | | | | | |
| Pickups | 71 | 83 | 84 | 75 | 82 | 88 | 81 | 91 | 80 | 82 | 82 |
| 1-2½ tons | 20 | 16 | 15 | 18 | 18 | 10 | 14 | 9 | 17 | 15 | 15 |
| Over 2½ tons | 9 | 1 | 1 | 7 | [1] | 2 | 5 | [1] | 3 | 3 | 3 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

[1]Less than 0.5 percent

Source: Unpublished data from 1975 Farm Production Expenditures Survey conducted jointly by the Economic Research Service and Statistical Reporting Service of the U.S. Department of Agriculture.



Table 6. Average number of autos and trucks available per farm, average total auto and truck miles and percentage of auto and truck miles by purpose, for farm production regions and U.S. total, 1975

| Item | Farm production region | | | | | | | | | | U.S. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | North east | Lake | Corn Belt | Northern Plains | Appalachian | South-east | Delta | Southern Plains | Mountain | Pacific | |
| | Average per farm | | | | | | | | | | |
| Autos and trucks available | 3.1 | 3.2 | 2.7 | 3.3 | 1.8 | 1.6 | 1.9 | 2.0 | 4.5 | 4.2 | 2.6 |
| Auto and truck miles | 24,610 | 25,636 | 24,423 | 24,962 | 15,307 | 16,424 | 20,341 | 22,935 | 36,695 | 32,769 | 22,875 |
| | Percentage | | | | | | | | | | |
| Auto and trucks miles used for: | | | | | | | | | | | |
| Farm business | 45 | 45 | 41 | 63 | 39 | 43 | 40 | 51 | 57 | 47 | 46 |
| Family use | 41 | 37 | 41 | 30 | 45 | 40 | 36 | 36 | 29 | 41 | 38 |
| Nonfarm business | 14 | 18 | 18 | 7 | 16 | 17 | 24 | 13 | 14 | 12 | 16 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: Unpublished data from 1975 Farm Production Expenditures Survey conducted jointly by the Economic Research Service and Statistical Reporting Service of the U.S. Department of Agriculture.

## OPERATING AND COST CHARACTERISTICS OF MOTOR VEHICLES

There are some strong economic as well as non-economic reasons why the availability and use of private motor vehicles exhibited by the data exist. Private motor vehicles have some inherent operating characteristics that in a rural setting make them the dominant travel mode. Among their advantages, besides speed, are their flexibility for a variety of distances and trip purposes; their door-to-door service with no transfers or waiting time; and finally, characteristics such as privacy, comfort, and ability to carry both passengers and small packages and light freight. Mobility provided by motor vehicles has also reduced the isolation of people engaged in farming and allowed them to carry on other rural economic activities and more social, cultural and political interaction. Perhaps the limited success of recent attempts to accommodate some of the appeals private motor vehicles offer with innovative transit systems indicate how tough a competitor this personal transport is in rural areas.

Motor vehicles do have some disadvantages, primarily environmental. However, without belittling these disadvantages, some of their polluting characteristics are less objectionable when they operate at the higher average speeds in the relatively uncongested rural settings. Also, for-hire service adapted to reasonable levels of frequency of service and direct routings could emit equal or even greater amount of pollutants. Others may consider some of the land use patterns resulting from the unrestricted mobility which motor vehicles provide an undesirable or negative externality, but farming and forestry are extensive land users by nature. Finally, the affordability of automobiles or trucks to many can be considered a disadvantage for some rural persons who are unable to afford the investment. The affordability reduces the base of potential ridership and the viability of for-hire passenger transport in a very thinly populated rural area or even in a more thickly settled area where work locations are on farms or nearby.

The characteristics of the motor vehicle when coupled with the residence patterns and travel needs in rural areas result in the predominance of the motor vehicle. If one word could characterize rural patterns of residence and economic activity, it would have to be—diversity. For example, the type and length of trips as well as their frequency would tend to vary according to the mix of economic activity in a rural community. A farming community would give rise to a set of trips different from that of a community with a manufacturing and agricultural mix—i.e., the relative importance of commuting trips would differ (3). The possible variations in trip types and lengths are usually met by a flexible transportation mode—the private motor vehicle.

*Cost*.—Underlying these operating characteristics of motor vehicles are the cost characteristics. The following analysis applies to automobiles and light trucks, although operating cost data are specifically for automobiles.

An individual incurs a cost in purchasing any transportation service. This cost consists of two components: The "out-of-pocket" transportation cost plus the cost of the individual's time spent in travel. These costs vary according to the type of mode used and the distance traveled. For example, if the household can meet its needs by walking, the out-of-pocket costs are negligible but the cost in terms of the time involved may be quite high for some. The transportation cost, $T$, can be expressed simply as:

$$T = FC + VC(d) + TTC(t)$$

Where $FC$ = fixed costs incurred by a mode
$VC$ = variable costs incurred which is a function of distance, $d$
$TTC$ = Travel time costs which are a function of time, $t$, spent in both arrangements for travel and travel time. This is likely a function of distance, frequency and regularity of trips.

The fixed costs and variable costs make up the out-of-pocket costs. For certain modes, the fixed costs are negligible, or they are incorporated into charges as though they are variable costs. An example is public transportation, where the household incurs variable costs, $VC$, in the form of fares based principally on distance. The private motor vehicle incurs fixed costs and variable costs. All modes incur travel time costs since the time spent enroute and in arranging for transport could be used for other purposes.

The U.S. Department of Transportation (DOT) has calculated the costs per mile of operating a standard-size, compact, and a subcompact automobile at 18, 15, and 13 cents a mile, respectively (9). These included both fixed and variable costs. For example, the fixed charges included depreciation, insurance, taxes and fees and, although not calculated by DOT, the finance charges or interest lost by financing the car oneself. Among the variable charges were the costs for gas and oil, maintenance, tolls, etc. Thus, given the assumptions concerning the number of years the automobile was to be kept, a reasonably accurate cost per mile was calculated.

However, the calculations yield only the "out-of-pocket" costs. If the travel time were included in the equation, the total costs might increase significantly. The hourly wage of an individual, or some portion of it, is often used to establish the value of his time. Therefore, the perceived cost of travel time could outweigh the out-of-pocket costs for most home-to-work travel. Also, in rural areas where low

population density and generally longer distances prevail, rather lengthy travel time could occur with other than private motor vehicles. These other modes would require, in many instances, longer waiting and travel times as individuals are picked up one by one. Circuitous routing to achieve higher seat capacity use also could add to travel time.

By examining the cost components of motor vehicles, it is easier to understand why there is a preference for them. Indeed, the fact that "out-of-pocket" costs are negligible in most instances vis-a-vis cost of travel time, for other than low income groups, helps explain the relative insensitivity of commuters to newly provided public transit.

## TRENDS AND IMPLICATIONS FOR THE FUTURE

The preceding sections have shown the extent of the use of private motor vehicles in rural areas, and suggested hypotheses as to why this mode is preferred. Several developments suggest that this dominance will not change appreciably in the near future. Perhaps one of the most important developments has been an apparent reversal in the rural-to-urban migration trend. Population grew at a faster rate in non-metro than in metro counties during 1970–73, a 4.2 versus 2.9 percent rate (1). Naturally, these reverse migration trends, if they continue, signal the need for additional transportation services and perhaps increased reliance on motor vehicles by these migrants, if they are, as supposed, more affluent than established rural residents.

Another trend which has implications for the type of people transportation system that prevails in rural areas is the extent of part-time farming. As job opportunities have increased in many rural areas, more members of farm families have taken off-farm jobs. More than half of the 2.7 million farm households reported some off-farm work by family members in 1969 (4). In fact, 40 percent or more of the off-farm workers in each of the farm production regions reported commuting 15 or more miles one-way to work, i.e., a round-trip distance of at least 30 miles (Table 7). Of the farm households who reported off-farm work in the production regions, between 50 and 60 percent traveled at least 22 miles round-trip to get to their off-farm jobs (Table 7). Such workers are not likely to be willing to give up the faster door-to-door service of private motor vehicles for other modes, unless circumstances change drastically (2).

While the need for private motor vehicles in rural areas will continue unabated, the cost of providing transportation for oneself and family likely will rise. Energy costs and general operating costs will rise. For example, the Statistical Reporting Service found that farm-operator families allocated almost 18 percent of their total family living expenditures on transportation in 1973 as compared to about 11 percent in 1955. In fact, the farm-operator family spent about 13 percent of its income before taxes for transportation in 1973 (8).

Nonetheless, the hard facts seem to be that under past cost and income circumstances, private motor vehicles were relatively too economical, convenient and comfortable for most rural residents without a physical or income constraint, to consider alterna-

Table 7. Percentage of off-farm workers by one-way commuting miles for farm production regions and U.S., 1975

| Region | One-way miles | | | | | Region | One-way miles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-5 | 6-10 | 11-15 | 15 or more | Total | | 1-5 | 6-10 | 11-15 | 15 or more | Total |
| | Percentage | | | | | | Percentage | | | | |
| Northeast | 16 | 21 | 24 | 39 | 100 | Delta | 15 | 19 | 17 | 49 | 100 |
| Lake | 15 | 20 | 16 | 49 | 100 | Southern Plains | 16 | 24 | 12 | 48 | 100 |
| Corn Belt | 21 | 19 | 18 | 42 | 100 | Mountain | 17 | 22 | 18 | 43 | 100 |
| Northern Plains | 24 | 19 | 17 | 40 | 100 | Pacific | 28 | 20 | 12 | 40 | 100 |
| Appalachian | 16 | 21 | 18 | 45 | 100 | U.S. | 19 | 21 | 16 | 44 | 100 |
| Southeast | 17 | 34 | 9 | 40 | 100 | | | | | | |

Source: Unpublished data from 1975 Farm Production Expenditures Survey conducted jointly by the Economic Research Service and Statistical Reporting Service of the U.S. Department of Agriculture.

tive modes of transport as serious contenders, especially in unscheduled local travel activities. This situation has left some rural residents isolated. Possibly, other forms of transport can be made economical and acceptable for many, if not most, rural trips. The market potential represented by local rural travel seems unlikely to call forth the R&D effort necessary to reach such a breakthrough in the near future. Perhaps our next papers will reveal such endeavors.

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# Intercity Bus Service to Rural and Small Urban Communities


Arnold L. Levine
Policy Planning Analyst
U.S. Department of Transportation


The purpose of this paper is to present some thoughts on intercity passenger transportation, in general, and on the provision of common carrier service to rural and small urban communities, in particular. It is emphasized that, although some research results are tucked in among the verbage of this presentation, it is indeed composed primarily of the author's *thoughts* about intercity passenger transportation in rural and small urban communities, its current status, the capabilities of carriers who are currently providing service to continue to do so, and the roles that various governmental agencies may have in providing support for those services. The comments presented in this paper do not by any means constitute a formal statement of federal transportation policy as it relates to intercity rural transportation, for that policy is still in its formative stages. Rather, its purpose is to attempt to elucidate the federal perspective, provide some background on the subject, to generate some discussion, and to point out the need for additional research.

Excluded from this discussion are common carrier air and intercity rail passenger service, the characteristics of which generally preclude either of them from being relied upon extensively to provide economic and efficient service to the vast majority of rural and small urban communities. Indeed, a nationwide sampling of some 230 communities found that only 12 percent and 4 percent of the communities with populations between 2,500 and 5,000 received direct air and rail service, respectively. In contrast, the intercity bus industry offered direct service (albeit at widely varying levels of service) to approximately 96 percent of the communities in that same population range. The scheduled airlines never have and it is clear that the railroads (i.e., Amtrak) will never again provide a significant portion of the intercity passenger service to lightly populated areas. In large measure, as the cost of transportation has increased, that service has been rendered solely by the intercity bus industry. That industry, however, is not immune to the same spiral of cost in-

creases and patronage decreases which ultimately spelled disaster for rail passenger service in the United States as well as for the Nation's privately-owned urban transit systems.

Today, while nearly 1,000 firms comprise the intercity bus industry, two stand out as dominant. Together, Greyhound Lines and Continental Trailways and their score of affiliates account for approximately 75 percent of all revenues generated in regular route service. They carry approximately 68 percent of the industry's regular route passengers. Both firms operate extensive transcontinental bus systems, designed primarily to serve larger population centers. In addition, however, both continue to operate networks of more or less regional or feeder routes to supplement their major through route systems.

The remaining 900 or so intercity bus firms generally operate less extensive systems. Some are major regional carriers, relying on regular route intercity service to generate the bulk of their revenue. Others offer little or no regular route service, being primarily charter and special service specialists. All regular route carriers typically supplement their passenger revenues by carrying parcels in the holds of their vehicles. Today package express service is a very important revenue generator for the industry, accounting for well over 10 percent of total revenues for many carriers and providing the margin of profitability on numerous routes.

For many years the strongest sector of the industry, regular route service is now perhaps the weakest. Charter and special service are generally strong and profitable. With relative ease, even residents of sparsely populated areas are able to acquire mass transportation to special events or for charter tours. In addition to the relatively long-haul services offered by interstate intercity bus firms, many charter and special services are provided by local school bus and intrastate operators over shorter distances. Although spot equipment shortages may be more likely to result in residents of rural and small urban communities being unable to charter intercity buses on short notice, by and large there appear to be few problems with this aspect of intercity passenger transportation.

Regular route service, however, is another matter. With the exception of the surge in patronage experienced by all common carriers during the oil embargo in 1974, the number of passengers carried in regular route service has declined steadily since 1968. In that year all Class I intercity bus firms, combined, carried approximately 146 million regular route passengers. By 1975 that figure had dropped by nearly 20 percent to approximately 117 million. During that same period average operating expenses per bus mile went from 68.4¢ to 105.3¢, an increase of 54 percent. To cover those rising costs fares have increased by roughly the same amount, further depressing patronage levels within this highly discretionary travel market.

As far as rural and small urban communities are concerned, these trends are reason for concern. For the bus companies themselves assert that services to these areas are operated on the most narrow of profit margins and that many operate at a loss, being cross-subsidized by more profitable regular route operations and by charter and special services. Indeed, the industry in its arguments against the regulatory reform measures proposed by the Department this past year, has further asserted that a lowering of the current regulatory barriers to entry would lead to a dilution of the profits realized on major routes which make continuation of service to rural and small communities possible.

The expense accounting procedures practiced by the industry do not permit route and service specific cost and revenue analyses to be performed. This lack of specificity has prevented the industry from moving beyond a general level of allegation on this point. The Department's analysis of the available data found nothing in the economic and financial characteristics of the industry to indicate that the industry's larger firms, many of which provide extensive service to rural and small urban communities, are more efficient operators than its smaller ones. Indeed, as far as being able to provide service at least cost, the evidence appears to indicate that larger firms are adversely affected by significant diseconomies of scale. This argues against a policy of protecting larger existing carriers from new entrants on the basis that the larger carriers are providing the best possible service to lightly populated areas at the least cost as a result of cross-subsidization. In order to more fully develop information on this important subject the Department has urged the National Association of Motor Bus Owners to undertake a survey of its membership in an effort to ascertain on a route and community specific basis those areas which the industry perceives would be in danger of losing intercity bus service (as it is presently offered) in the event freer entry and exit are achieved. NAMBO is now in the process of doing so. The task is by no means a simple one and the Department intends to work closely with NAMBO in an effort to ensure its accuracy and comprehensiveness.

NAMBO's research effort, however, will not examine alternative methods of providing intercity service to those areas identified as being in danger of losing service currently offered by existing carriers. Regardless of whether the industry claims massive route discontinuances are on the immediate horizon, or not, alternative means of financing and providing that service must be explored.

One alternative method of maintaining service which comes to mind (and perhaps too quickly) is for government to relieve private industry of its alleged burden by subsidizing intercity bus service for rural and small urban communities. Various states have

contemplated this approach (e.g., New York, Oregon, and Michigan) and the state of Michigan in the past year has implemented a program to provide route and service specific operating assistance to the state's intercity bus firms. That state has also established an intercity bus vehicle loan program. From the Federal perspective, however, direct financial assistance earmarked to offset the operating deficits of the intercity bus industry must be considered as an alternative of last resort. If nothing else, the Amtrak experience surely has taught us that.

There are several reasons for this position. First, it is not clear what an appropriate level of intercity bus service is, and to provide financial assistance to preserve existing levels presumes that level is adequate—no more, no less. This is clearly not the case, however. Second, much of the rural and small urban community service under discussion is intrastate in nature and difficult to categorize as intercity or local. For the Federal government to advocate the establishment of a financial assistance program along the lines of the Amtrak program would be presumptive at best and most likely ineffective and wasteful. Third, and perhaps most important, such a program takes as given the premise that existing carriers are the best qualified to provide service to rural and small urban communities and that current methods of operation are the most appropriate as well. Again, it is not at all clear that either is the case. Certainly it becomes difficult to convincingly argue, for example, that Greyhound Lines is providing the most effective and efficient service possible for rural and small urban communities when there are an abundance of intercity bus firms and other transportation concerns capable of providing similar service at roughly one-half the cost. In short, serious consideration to a direct earmarked operating subsidy program should be given only after all other non-subsidy alternatives have been tested. The Department has proposed just one alternative, lowering the barriers to entry and exit. The purpose of this paper is to elicit others.

Many questions concerning intercity bus service for rural and small urban communities remain unanswered. One thing is very clear, however; regularly scheduled intercity bus service to these areas has deteriorated in recent years. That trend is likely to continue unless some changes are made. Service standards proposed by the Interstate Commerce Commission (Ex Parte No. MC-95), if implemented would most likely accelerate that deterioration by imposing unrealistically high standards for service to those communities, eliminating much of the flexibility and low cost features which characterize intercity bus operations. The Department is anxious to join with state and local governments, academia, the intercity bus industry, and other potential providers of transportation services to explore potential alternative means of providing that service.

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# Air Service to Small Communities

Regina Van Duzee
Office of Aviation Policy, Federal Aviation Administration
U.S. Department of Transportation

It is generally conceded that air transportation to small communities has deteriorated in recent years as increasing numbers have lost service and have been removed from the national air network. Air service is important to rural areas. Not only do airlines transport people for business and pleasure but they also carry agricultural products such as strawberries, flowers, and baby chicks, and high cost industrial products such as automobile parts and medical supplies. The need for rapid delivery of farm machinery parts as a means of avoiding a day's delay in harvest season is obvious. Surveys show that business firms prefer locations that have an airport and air service over those that do not. This paper will sketch some of the history of rural air transportation and describe the air transportation system as it is today. It will discuss the economic value of air service, some problems encountered in trying to improve service and suggest some areas in which research is needed.

For the purpose of this paper a small community is defined as one having a population of 50,000 or less. It must be remembered, however, that a city of 50,000 people in the East may service a relatively small area since there are other larger population centers nearby. Pennsylvania offers an example. There are thirteen cities of over 50,000, the largest of which is Philadelphia with 1.9 million, in a State with an area of 45,333 square miles. In the Midwest and far West, a community as small as 5000 may be the economic and transportation center for a large area. In contrast to Pennsylvania, Kansas has an area of 82,264 square miles but only three cities of more than 50,000. The largest, Kansas City, has 676,000 people (including both the Kansas and Missouri sides). Great Bend, Kansas is a thriving community of 20,000 centered in an agricultural area. It serves a geographical area extending about 40 miles to the east and 125 miles in the other three directions, an area of more than 10,000 square miles. Certificated air service at Great Bend was deleted, and it now relies on commuter-type service.

## HISTORY

In its formative years, the U.S. air transportation system consisted of a group of trunk carriers making transcontinental flights in a series of short hops. The passage of the Aviation Act of 1938 nurtured the infant industry. The Act formed the Civil Aeronautics Board (CAB) charging it with responsibility to regulate air transportation, to foster sound economic conditions in the industry and to coordinate civil air transport. As the original trunk carriers grew and the capabilities of their aircraft improved, they concentrated services in the long-haul routes, limiting and in some cases even reversing expansion to smaller communities. A group of airlines later referred to as local service carriers started operating to the low density short-haul points. The DC-3 dominated the early local service fleet because it was available at low cost after World War II. At that time experienced mechanics and pilots were also available. The average flight between stops was 64 miles, and each of the average 5.6 passengers on board traveled about 200 miles.

The Board encouraged the development of a group of carriers specializing in providing air service to

short-haul, low density air points. The Board recognized, however, that service at points with limited traffic potential might be economically difficult and was prepared to provide subsidy. It was assumed that as traffic developed, subsidy needs would decrease. However, rapidly developing aircraft technology interfered with this plan. As larger, faster, more efficient jet equipment appeared on the scene, the local service carriers, seeing the cost and service advantages, moved to equip their fleets with the more efficient aircraft. But the DC-9's and B-737's developed for the short-haul market also contained more seats. Those low density points that might provide sufficient load factors to support a Convair or Fairchild 227, would not provide a breakeven load factor on the larger craft despite their efficiency. In addition, once the move to jets was well underway, commonality of fleet became an important factor and the local service carriers proceeded to eliminate the older turboprop aircraft from their fleets. Today there are only 147 turboprops still in the local service fleet and most of these would be disposed of if their owners were permitted to abandon the points at which they are utilized. In its efforts to aid the industry in obtaining a reasonable return on investment and to lower subsidies, the CAB granted local service carriers increasingly longer routes so that they have become in essence regional carriers. The pattern of local service carriers replacing trunks now repeats itself. Commuter carriers using small aircraft better tailored to the market are replacing local service carriers in communities that do not generate sufficient traffic to support large aircraft.

## RURAL AIR SERVICE TODAY

The CAB has been liberal in allowing certificated carriers to abandon service at unprofitable points when adequate replacement service can be provided. At the end of 1970, certificated carriers were serving 435 of 467 authorized points. By the end of 1975, they were serving 382 of 433 authorized points—a decline of almost 12 percent. Some of these dropped points have been permanently removed from the carriers' route certificates while others are under temporary suspension. Of the 647 communities receiving air service in the 48 contiguous states, 218, almost 34 percent, are served exclusively by commuter airlines.

Commuters were first formally recognized by the CAB in 1969 when they were defined as those carriers operating by exemption under Part 298 who either perform at least five regularly scheduled round trips per week between two or more points or transport mail. They are subject to limited regulation and reporting requirements, are allowed free access to all markets, and have no route protection. They are permitted to operate aircraft up to 7,500 pound payload carrying a maximum of 30 passengers.

An analysis of CAB data by the Office of the Secretary of Transportation highlighted the changes in service to communities under 100,000 population as illustrated by Table 1. In 1970, 44 of those points were served by trunk carriers, 239 by local service carriers and 187 by commuters. In 1975, the numbers were 36 for trunk, 204 for local service and 224 for commuters—a decrease of 18.2 percent for the trunks, 14.6 percent for locals and an *increase* of 19.8 for commuters.

Table 2 indicates that the pattern of service is also changing. In 1970, trunks and locals offered a total of 9,075 weekly flights and commuters 6,324. In 1975, the total was 7,676 compared to 7,126 offered by commuters. The percentage decreases for trunks and locals were 2.9 and 17.7, respectively with commuters showing 12.9 percent increase (4). If the upper population limit of this study were set at 50,000, the change would be even more striking. It is apparent that the trend toward decreased local service by certificated carriers is real.

A number of states and regional commissions have been grappling with the problem of reduced service to their rural areas and have produced studies that bear on the subject. An Iowa State University study (3), indicates that there has been a consistent decline in the quality of public transportation service in Iowa. The level of bus service and rail passenger service has decreased sharply. Railroad mileage is declining and motor truck service is of uncertain quality. Commercial air service affords extremely limited coverage and air charter service is not widely used. The net result is that residents of smaller communities are limited almost exclusively to automobile travel for personal mobility and are strongly dependent upon private trucking for movements of goods.

However, it is difficult to measure how much of the shift to the automobile is due to a decline in available public transport. Some may be attributed to personal preference and the improvement of the highway system.

The study found intrastate air service very limited and inconvenient. From Burlington, Iowa, located in the southwestern corner of the state, it is necessary to make connections in St. Louis or Chicago to reach any other Iowa city. Des Moines is the only city in Iowa having reasonably adequate north-south service. To travel north from Ft. Dodge in Central Iowa to Minneapolis, it is necessary to make connections in Chicago or Omaha. Consequently, it takes considerably less time to drive the 225 miles to Minneapolis than to fly on the circuitous route.

The Ozarks Regional Commission (ORC), which includes the states of Arkansas, Kansas, Louisiana, Missouri, and Oklahoma also sponsored a study of regional air service (1). Although 80 cities in that region once had air service, now only 44 are served by certificated carriers. According to the report, recent studies and Government statistics demonstrate

Table 1. Air service to communities under 100,000 population, number of points served by type of carrier and size of community, 1970 and 1975

| Size of community[1] | 1970 | | | 1975 | | |
|---|---|---|---|---|---|---|
| | Trunk | Local | Commuter | Trunk | Local | Commuter |
| | No. of points served | | | | | |
| 0-25,000 | 17 | 131 | 113 | 13 | 112 | 144 |
| 25,000-50,000 | 18 | 80 | 52 | 16 | 66 | 60 |
| 50,000-75,000 | 3 | 12 | 10 | 2 | 11 | 10 |
| 75,000-100,000 | 6 | 16 | 12 | 5 | 15 | 10 |
| Total | 44 | 239 | 187 | 36 | 204 | 224 |

| Percent change: 1970-75 | Trunk | Local | Commuter |
|---|---|---|---|
| 0-25,000 | -23.5 | -14.5 | 27.4 |
| 25,000-50,000 | -11.1 | -17.5 | 15.4 |
| 50,000-75,000 | -33.3 | -8.3 | 0 |
| 75,000-100,000 | -16.7 | -6.2 | -16.7 |
| Total | -18.2 | -14.6 | 19.8 |

[1]1970 population.

Source: Data from Civil Aeronautics Board

that the population migration to urban areas which began after World War II, has reversed both nationally and within the OR region—the trend perhaps is due in part to a recognition of the attractive quality of life in small communities and the lower living costs. The study points out that while the larger cities are typically served by a number of certificated carriers, the smaller community must rely on one carrier. When that carrier is faced with increasing costs and insufficient traffic, it can not meet expenses. As a result, it applies for permission to suspend service. Without this carrier, no alternative service is available to the small community air traveler.

## ECONOMIC VALUE OF AIR SERVICE

The need for air service in rural communities is not always obvious to planners. A frequently advanced argument states that if the residents really need and want air service they will be willing to pay the cost of supporting it—either in the form of patronage or local subsidy. Although complete local support may be a worthy long-term goal, if one looks at the problem from the larger viewpoint of encouraging economic development of the Nation's rural areas, the role played by air service becomes apparent.

The U.S. Department of Commerce conducted a survey of 3,000 manufacturing firms to determine factors influencing industrial location decisions (2). The availability of scheduled air service and the preferred community size were two survey items. Thirty-six percent of the firms responding indicated that the presence of scheduled air service was of average significance in their location decisions. For 11 percent availability of air service was considered critical; and for 17 percent, significant. Surprisingly, cities of under 25,000 were the preferred size for 20 percent of the firms with 38 percent choosing cities of 50,000 or less.

The airport itself is also an important factor in attracting industry. Of the Fortune 1,000 top companies, 451 operate corporate aircraft. There are, in fact, 5,500 executive aircraft in corporate fleets flying 1.77 million hours a year. There are another 40,500 general aviation type aircraft used for business flying. Companies have consistently listed the availability of an airport among the top cirteria for

Table 2. Air service to communities under 100,000 population, number of weekly flights by type of carrier and size of community, 1970 and 1975

| Size of community[1] | 1970 | | | 1975 | | |
|---|---|---|---|---|---|---|
| | Trunk | Local | Commuter | Trunk | Local | Commuter |
| | No. of weekly flights | | | | | |
| 0-25,000 | 279 | 3,332 | 3,446 | 250 | 2,806 | 3,722 |
| 25,000-50,000 | 564 | 2,949 | 1,838 | 603 | 2,359 | 2,002 |
| 50,000-75,000 | 119 | 556 | 544 | 132 | 431 | 689 |
| 75,000-100,000 | 437 | 839 | 496 | 373 | 722 | 713 |
| Total | 1,399 | 7,676 | 6,324 | 1,358 | 6,318 | 7,126 |

| Percent change: 1970-75 | Trunk | Local | Commuter |
|---|---|---|---|
| 0-25,000 | -10.4 | -15.7 | 8.0 |
| 25,000-50,000 | 6.9 | -20.0 | 8.9 |
| 50,000-75,000 | 10.9 | -22.4 | 26.6 |
| 75,000-100,000 | -14.6 | -13.9 | 43.7 |
| Total | -2.9 | -17.7 | 12.9 |

[1]1970 population.

Source: Data from Civil Aeronautics Board

selecting new plant locations. A survey of leading U.S. firms revealed that 80 percent would not locate a plant in an area lacking an airport and 57 percent indicated that the airport should be capable of handling heavy twin-engine aircraft.

Although we think of air service, particularly that offered by commuters, as being used primarily for carriage of passengers, cargo and mail carriage is also important to rural areas. With the cutback in passenger rail service, the post office had to search for other means of moving mail. Trucks are, of course, the most obvious answer but the post office department has also successfully utilized commuters. By recent count, the Postal Service had 110 mail contracts with commuter operators worth about $15 million, providing service to 200 cities.

A number of products from rural areas are shipped by air. Harbour Airlines transports fish from Astoria, Oregon to Portland and thence on to other cities. Sedalia, Marshall, Boone Airline (SMB) carries parts for farm machinery. In fact, the manufacturers of farm machinery have support systems developed for fast delivery of equipment parts. Deere and Company, Moline, Illinois, has a "flash" service promising one day delivery. To achieve this, they frequently must utilize commuters to reach remote points in order to avoid the difference between a day's lay up of equipment during the harvest season. Emery Air Freight ships 10-pound grain samples by commuter from rural areas for transhipment to foreign countries.

The benefits of rural air service are manifest. It aids economic development and quality of life by offering rural citizens linkage to the national transportation network, access to recreational areas and special emergency services, such as air ambulance.

## MEASURES TO IMPROVE RURAL AIR SERVICE

With rural needs in mind, the Department of Transportation included in the proposed Aviation Act of 1975 a provision that commuter airlines be permitted to operate aircraft up to 56 passenger size without additional CAB regulation. It also added the Small Communities Subsidy Amendment. The

amendment was designed to ensure air service until January 1, 1986, to those small communities that were receiving service on January 1, 1976. It provided that a community not receiving essential air transportation can apply to the CAB for assistance. The Board upon determining that the transportation is essential, would contract with an air carrier to provide that service for three years with extension possible. The Office of the Secretary of Transportation is now in the process of revising the proposed Legislation to improve it and some changes may be made in the amendment. The Office would appreciate having suggestions from those to whom this is a major concern.

Rural areas must face economic reality when assessing their air service needs. Many communities are extremely reluctant to lose even poor certificated carrier service because of the prestige factor involved and a preference for large aircraft. However, certificated carriers providing service to small communities are faced with inflationary problems common to all plus additional costs unique to small community service. The cost factors are age, fuel inefficiency, and high unit operating costs of the aircraft used to serve these cities, cost pressures created by operating aircraft disproportionate to passenger demand, and federal subsidy which fails to cover the cost of service. Low traffic areas must realize that the hope for adequate future service lies in an expanded network of commuter carriers.

In many areas, there may be limited public acceptance of commuters. Some people are concerned about reliability of service and the comfort and safety of small airplanes. There is perhaps an educational task for state and local people to provide information about commuter service in areas where it has been successful. It is possible a series of case studies of successful commuters should be undertaken. The studies should be directed to determining the community attitude toward them, how they have obtained community support, growth problems they have encountered and economic and life style benefits they have provided.

Another areas in which research is needed concerns subsidy. Although commuters are not subsidized now, the possibility of subsidizing either the airlines themselves or the small communities they serve has been suggested, but the cost of such a program has not been determined. In 1975, local service carriers received $60 million in subsidies. If commuters were to replace those carriers at some subsidized points, some kind of start-up subsidy might be investigated—particularly at remote thinly populated areas where there is a public need for service. It would be useful to have some carefully documented estimate of what the dollar amount might be.

I hope the foregoing discussion may suggest some areas in which research might be carried out. Needless to say, there are many people at the federal level, both in the Administration and in Congress devoting their attention to finding ways to improve rural transportation.

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# Characteristics of Rural Transit Systems[1]*


Arthur Saltzman
Director (On leave 1976–1977)
Transportation Institute, North Carolina A&T State University


The delivery of social, health and welfare services is accomplished by a wide variety of local agencies. Used in this sense, "delivery" implies the entire process by which these human services are provided to agency clients. Thus, organizations established to perform this delivery function must be concerned not only with the quality of their services, but also ways of ensuring that there is access to the services among target groups of the agencies.

Transportation for clients has often been cited by agency directors as a problem area in service delivery. Often an agency has opened its doors for business and rapidly found that it was able to serve only a fraction of its potential client group because of ac-

*Editor's note: Topic suggested by Planning Committee was "Feasibility of Demand Responsive Transportation for Transportation Disadvantaged Rural People."

cess problems. This usually stemmed either from the autolessness of the agency client—this is especially true of elderly, handicapped, and poor persons—or from the lack of adequate public transportation.

It is this second factor that makes the access problem particularly acute in rural areas. Few transit operators are found in low density areas. Even when there is a nearby local urban transit operation it rarely provides mobility for residents of rural areas which are adjacent to the urbanized area. Peak hour commuter lines to suburban areas are frequently found, but a person in a rural area usually has no transit option available.

Human service agencies in rural areas have responded to this access problem by attempting to provide transportation services for their clients. Small and occassionally large transit operations have been established to improve the entire delivery system. While not ubiquitous, these special transit services have been initiated by a wide variety of agencies, funded by various federal, state and local agencies, and have had a varied degree of success in effectively increasing the mobility of agency clients.

Twelve of these rural transit systems were visited by members of the Transportation Institute at North Carolina A&T State University as part of a research project in rural public transportation. The research team attempted to synthesize the steps that were taken in the conceptualization, planning and implementation of these systems.

A model of this process was developed which contains the most successful techniques used in each phase. In addition, some of the major operational problem areas of rural transit systems were identified and analyzed. A review of the synthesis and the problem analysis is the subject of the remainder of this paper. These topics will be introduced by a review of the operating characteristics of selected rural transit operations.

## SYSTEM CHARACTERISTICS

Rural public transportation systems can be classified as paratransit; that is, they are not operated by conventional transit operators and usually have service characteristics that differ from conventional urban transit. Rural transit is different from conventional urban transit primarily because it serves different clientele and trip purposes. While urban transit focuses on the journey-to-work of the general population, the rural transit operator is trying to serve the needs of poor, elderly and handicapped persons and their non-work related trips.

Of course, the above is an oversimplification for a few reasons. First is that conventional operators, as a result of recent federal legislation, have been devoting a small but increasing portion of their resources to serving these transportation disadvantaged groups who have different trip making needs than the general population. Second, there also exist in virtually all urban areas paratransit operations which provide transportation to human service and health agency clients. These urban areas usually have two types of transit entities which co-exist. The third oversimplification is that rural transit operators are trying to serve only poor, elderly and handicapped groups. Although this is a primary focus of most rural systems, there are an increasing number which also serve the general population. Finally, in addition to shopping, medical and social service delivery trips, there are a few rural transit operators who try to service local work trip needs.

Although the original descriptions were oversimplified, it is important to reiterate that these general descriptions are usually accurate: Rural systems serve the non-work related trips of the transportation disadvantaged and urban transit focuses on the journey-to-work of the general population.

In the following sections, the specific characteristics of rural transit systems will be discussed. Because the transportation community has a general familiarity with urban transit, the rural and urban differences will be emphasized in these discussions. A primary data source for these discussions is the recent report on Rural Passenger Transportation from the Transportation Systems Center of the U.S. Department of Transportation (2). This document summarizes information on 75 rural transit systems. A substantial portion of the system information was derived from data supplied by the Transportation Institute of North Carolina A&T State University. The author's familiarity with the original data will thus enable him to discuss its biases as well as analyze the system characteristics.

### Routes and Schedules

Rural transit routes and schedules are more flexible than those of conventional urban transit systems. For example, 27 (36%) of the 75 rural transit systems that were identified in the Transportation Systems Center (TSC) report were demand-responsive, 29 (39%) were fixed route, and 19 (25%) were a combination of fixed route and demand-responsive. Indeed, even the routes which were identified as fixed routes were not very similar to conventional transit fixed route systems in that they usually provided service once a day. Daily service for at least 5 days per week was reported for 77% of the systems. This means that there was at least one vehicle dispatched on a daily basis but it should be noted that this does not imply daily service along each route. Some smaller systems, for example, serve a different geographical area on each day of the week. This should be compared with the more frequent service which is typical of urban transit.

In a similar vein, the demand-responsive designation usually means something quite different when applied to the rural setting. In urban areas that have

introduced demand-responsive Dial-A-Ride systems, the customer can usually request door-stop service and be picked up within an hour. Demand-responsive services in rural areas usually are on a reservation basis. One day to a week prior notice is required.

### Target Groups

As indicated earlier, rural systems usually focus on particular population sub-groups. In over half of the rural transportation projects mentioned earlier, more than one group is given as a target. The elderly is the largest single target group identified in the 75 selected rural transportation projects mentioned earlier. Over three quarters of these systems serve the elderly either exclusively or as one of the primary client groups. Some projects also identified other groups as prime clients, including the poor, Head Start pupils, and the handicapped. Members of transportation cooperatives, workers, and university students were also some of the target groups. The general public was listed as a target group on only 6 of the 75 systems. This is a clear indication of the specialized nature of the services offered by rural transit operations as compared to the focus on the general public which characterizes virtually all urban systems.

### Trip Purposes

Related to target groups are the trip purposes served by rural transit. As expected, the trip purposes of rural transit patrons are quite different from those of conventional transit. Trip purposes served by the same projects were mainly in four areas; medical services, shopping, general, and social services. This is quite different from the work-oriented public transportation found in most urban areas. In the rural systems only 3 of 75 listed work as a trip purpose.

### Geographical Area Served

While urban transit systems usually have a clearly defined urbanized area as their service domain, in rural situations no such easy correspondences exist. Examples exist of single county, multi-county and state-wide systems. The county is usually the minimum area that is served. This is often a function of the area coverage of the human service agencies whose clients are being served by the system. Thus, in the TSC report, 57 percent of the systems served one county and 37 percent were multi-county. Only 3 (4%) were considered statewide, while 1 covered an entire Indian reservation. In theory, the dispersed nature of rural transportation should mean that larger systems are desirable. In practice, however, trying to get counties to cooperate with one another is often impossible. This is not just in the area of transportation. It can be a problem in all ventures involving the provision of public services in areas of more than one jurisdiction.

### Sponsoring Agencies

It is difficult to say just how representative the survey of rural transit systems was of all rural transit. No claim was made as to the representativeness of the sample, although it is likely that it was biased toward larger operations since data are most readily available for these systems. In addition, there was probably an over-representation of Community Action Agency (CAA) based systems. It was these agencies that were the focus of an A&T research project which supplied a substantial part of the data used to compile the TSC system survey. The TSC survey reported that CAA's were sponsoring agencies for 36 (48%) of the 75 systems that were reported. Areawide agencies on Aging sponsored 14 (19%) operations, while there were also significant but small numbers of systems sponsored by local government or a separate transportation agency established specifically for the purpose of providing service. Other sponsors included private profit-making firms and other state human service agencies.

### Fare Structure

Fare policies varied. Some systems were free to the rider, while others had a set fare or requested voluntary donations. This again was indicative of the nature of the population target group which generally tended to be poor, elderly or handicapped. The no-fare system was sometimes used to attract more riders, but it has been reported that some operators impose a fare to try to avoid the image of it being a free ride on a poor peoples' bus (1). Voluntary donations were used often, but usually resulted in very low revenue per trip. Even in the case where there was a set fare, the revenue thus generated was only a small percent of the total cost of operating the system. Since the systems are concerned with the delivery of social and health services, they are loathe to allow fares to discourage ridership and fares are kept extremely low and non-coercive.

### Financial Support

Again, this seemed to be a biased sample in that the Office of Economic Opportunity, now the Community Service Administration (CSA), working through local CAA's, was the sponsor of 35 of the

systems. Some systems using multiple funding sources were noted. In many cases there were two or more agencies providing financial assistance. Funds from the Administration on Aging were involved in 23 (31%) of the operations while there were a number of other Federal agencies, such as the Department of Labor and the Department of Transportation which contributed funds to some systems. Financial support also came from state and local sources, contractors and foundations and businesses.

## SYNTHESIS OF THE PLANNING AND IMPLEMENTING PROCESS

During the field site visits to the 12 rural transit systems data were gathered on the development of each system. Interviews with local agency personnel included discussion of the steps that were taken to initiate each system. From these interviews and subsequent discussion with others in rural transit, a simple model of the process was developed. This model, shown in Figure 1, shows the planning and implementation sequence for a typical rural transit operation.

In the sections which follow each of the steps in the planning process are reviewed. Some insights into the process are given. In addition, recommendations are suggested on how to make good decisions. A much more detailed review of this section will be found in the forthcoming document "Planning and Implementing Rural Public Transportation Systems: A Handbook on How to Make Decisions" which is being prepared by the Transportation Institute of North Carolina A&T State University under the research project previously described.

### Perceived Problem

As mentioned earlier, the problem is usually perceived by agency personnel whose clients are having transportation problems. The initiator can be a perceptive agency head or a staff member who is spending an inordinate amount of time driving clients to and from appointments. Stories have also been told of the problem surfacing when agencies become aware of the exorbitant prices being paid by clients to get to their appointments. Rural residents have reported paying $25.00 for a monthly roundtrip of 20 miles to visit a medical clinic.

### Problem Defined

Defining the problem is the next logical step. In this phase the boundaries and extent of the problem should be analyzed. As the first step in an ongoing planning process, a planning group should be established. A set of initial goals and objectives should be formulated and a clear statement of the mobility problem must be developed.

Unfortunately, this problem definition phase is often overlooked or bypassed. Frequently project funds remaining at the end of a fiscal year are used to buy some vehicles with very little consideration of the client's transportation needs and how best to serve them. The importance of the entire planning process is discussed in subsequent sections of this paper.

### Needs and Feasibility Study

The Needs and Feasibility Study is the next phase indicated in Figure I. This is the most critical step in

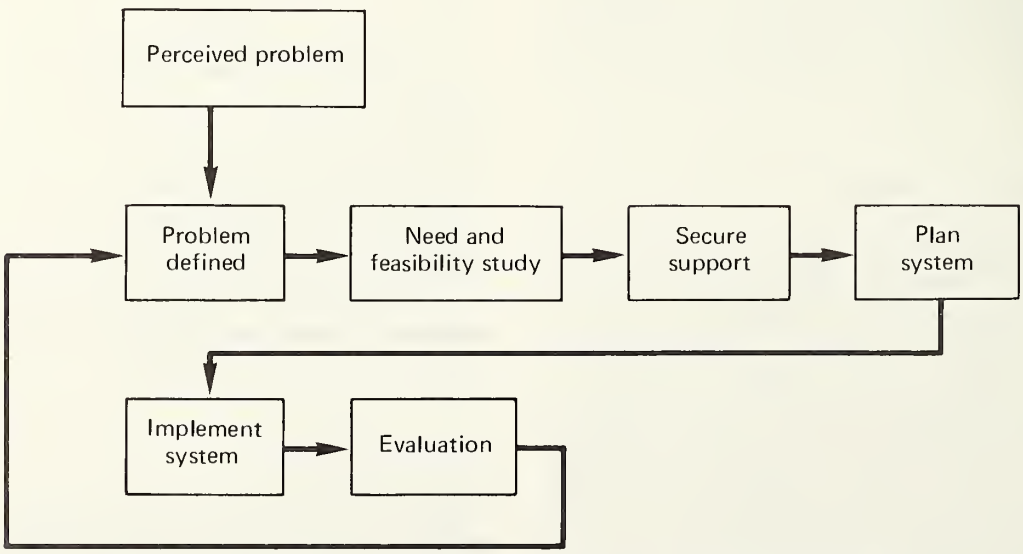


**Figure 1. Rural public transportation systems planning and implementation sequence**

the planning of the system. This phase starts with a well-defined mobility problem and concludes with an assessment of whether or not a transit system should be started. Geographical coverage and the target population are considered first. Next, a number of simple surveys are used to estimate the number of trips (need or demand) that will be taken if a system is implemented. Enough data are available on the ridership of existing systems that a demand estimate derived from the surveys should be compared with actual ridership information from similar systems.

Overestimating demand is the most frequent and often the most devastating mistake that can be made during this phase. Comparison with other similar systems is the easiest way to avoid this common error.

The demand estimate is then used with cost estimates to decide whether to proceed with subsequent steps. Admittedly, by this time there is momentum to the process and it is rare that progress will stop here. However, some planners would have been wiser to have made a "no go" decision because of low potential demand than to start a system whose sparse ridership resulted in high costs per trip and the eventual demise or drastic changes in the system.

Once the decision to implement has been made, the planning group should be involved in the securing of both financial and institutional support and the final planning and design of the system. Depending on local circumstances, these can be done sequentially in the order indicated in Figure 1 or in reverse order, or they may be done concurrently.

## Secure Support

Securing financial support means, first, identifying the avilable funding sources and then securing adequate funds to start and operate a viable system. There are many potential sources that exist at all levels of government. Over 50 separate federal programs that provide project funds for the transportation of elderly, handicapped and poor persons have been identified. A myriad of eligibility requirements exist. The planner is cautioned not to spend time in contact with funding agency representatives unless there is a reasonable probability that the proposed project is eligible and will receive funding if a proposal is prepared. Rural transit system managers usually spend an inordinate amount of their time pursuing funding.

As important in the long run as receiving financial support, is the enthusiasm and support for the system that can be generated in the potential service area. This means establishing a broad base of support among human service agency personnel, agency clients, local businessmen and elected officials. It is at this point that a citizen advisory group can be used to promote the system. Also important at this stage is the support of the state's and regional transportation officials who are likely to be involved in any proposal for project funding.

## Plan System

A final plan for implementing the system as well as a detailed design are the primary outputs of this phase. Data from the Needs and Feasibility study are used to decide on the type of service (fixed route, demand responsive or combination) and frequency of service. Other service-related decisions, such as fares, routing and scheduling procedures and eligibility requirements, are determined. Decisions are also made on equipment, including vehicles, communication apparatus and whether to use contract or in-house vehicle maintenance.

This is where attention to details and a thorough analysis of the effect of each alternative are the key factors. The system manager should have been hired or appointed by the time this phase is underway. Since the manager's decision will be the major factor that determines the success of the system, it is imperative that the manager participate in the final planning and design phases.

## Implement System

Getting the system started is inevitably a more difficult task than was envisioned by the planners. Delays in hiring the staff, ordering and receiving vehicles and receiving funds are some of the problems that must be dealt with during the start-up period. As in any business venture, some internal procedures must be established. Particularly important are the choices of an accounting procedure and other routine data collection efforts. The manager and staff must decide on what information should be collected and tabulated and how often this is to be done.

Personnel-related items are also included under implementation. Even before the staff is hired, job descriptions should be prepared and personnel policies established. A set of rules governing the activities of drivers and dispatchers is also needed.

A marketing effort must be developed. Although advertising is important, the marketing effort should permeate the entire system. Courteous drivers, clean buses, and reliable service are likely to reap more dividends than any advertising campaign.

## Evaluation

The tendency is for the manager to devote all of his time and energy to procuring funds and handling the daily crises that must be solved to keep the operation functioning. This leaves little time for ongoing evaluation of the system. But some evaluation is

necessary, especially when public funds are being used.

The evaluation process depends on the existence of a set of measureable objectives. Also required are data on the performance of the operation. This must be kept in mind during the implementation phase when record-keeping requirements are being established. Trends of costs and ridership are always needed, but a meaningful evaluation procedure will also include other indications of the effectiveness and efficiency of the system.

As indicated in Figure 1, the results of the evaluation should be used to determine if the transportation problem is being solved. Are agency clients receiving increased mobility and has the human service delivery system been improved by the rural transit system?

## FOOTNOTE

[1]This paper is an outgrowth of a research effort sponsored by the Office of University Research of the U.S. Department of Transportation under contract DOT-OS-40005.

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# Rural People, Places and Services: What Should Move Which Way?[1]

Paul W. Barkley
Professor of Agricultural Economics
Washington State University

The U.S. public seems to have a fixation on mobility. The historical antecedents to this fix are not hard to trace so the interest is understandable. People want to move in search of opportunity and in search of diversion. Economics and economists are interested in transportation and their interest, too, is easily traced. Adam Smith commented on the value of expanding the market. Following this admonition has required that transportation be readily available. In this century, the economists who developed the impressive micro models of neo-classical economics made an urgent case for mobility: Factors had to be mobile if a system was to attain maximum efficiency. This mobility required transport systems. The need for transportation grows as an economy becomes more specialized. The U.S. economy is highly specialized, therefore, it requires mobility.

The recent wave of economists' interest in transportation is about fifteen years old. While earlier waves concentrated on efficiency in the movement of factors and products and solving the rush hour turmoil of metropolitan areas, the recent interest includes a dimension related to moving people in rural areas. Research on this theme is extremely primitive and it is quite possible that this interest is not as fully developed as it should be. We may therefore, be missing several important opportunities to contribute to research and economic theory as well as transport policy.

This paper is concerned with moving people who reside in rural areas. Many issues impinging on the mobility requirements of rural residents need to be addressed, but the problems of location, technology, time, productivity, cultural inertia, and personal independence combine to make the theme a very complex one—much more complex than the problems of improving metropolitan rapid transit systems, reinstigating convenient transcontinental rail service, or determining "just and fair" freight rates. Despite its complexity, the problem must be joined. This discussion is divided into sections dealing with the movement of factors, the problems of fixed and variable costs, and the problems of moving things rather than moving people. It ends with a list of some themes for research. Through all this, it is admitted that potatoes and people can often use the same transport facilities but the emphasis here will always be on people. Similarly, it is admitted that there are many opportunities for transfers of methods and technologies between rural and urban areas but the emphasis will be on rural areas.

## THE MOVEMENT OF FACTORS

As early as 1800, economists were talking about land, labor and capital. Somewhat later, they added

entrepreneurship to round out the factors of production as we consider them today. No production process can be carried out without at least two factors being present; most require all four. Therefore, factors must move if they are to be productive. Capital moves to industrial complexes, entrepreneurship moves to commercial and trade centers. Land does not move, but the many energy related resources that count as land do move before they become part of the production process.

Labor moves, too. But labor is quite different. Labor moves from industry to industry to accommodate different marginal productivities and structural change. This kind of movement requires mobility but is not overly encumbered by a lack of transport capital or facilities. The move from east to west in the 1800s and the move from south to north in the 1900s would have taken place even if transport systems had been much poorer than they were. The uniqueness in labor comes from the fact that it must be constantly moving. While capital is installed once, or in some exceptional cases a few times during its productive life, labor is forced to come to one capital fixture each day and return to another capital fixture each night. Coal makes a single journey from pit to furnace; the labor that mines the coal and feeds the furnace must make many trips during its productive years. Thus, labor stands out as a peculiar factor of production—especially with respect to transport and mobility. It must be mobile to take advantage of changing productivities and it must be mobile to maintain itself as a productive factor within any industry.

The relationship between mobility and productivity has not escaped attention. It has been used to justify the elaborate systems of mass transit that surround the nation's cities and it has been used to justify the paving of rural roads in the nation's poorer areas. The problem of easing the daily trip between home and work has been a continuing one because easing the daily trip has been assumed to contribute to output and, hence, to the productivity of labor and other factors.

Another peculiarity surrounds labor. "Labor" as it is commonly construed includes physical effort, skill, and native ability. Although all labor comes from human effort, all human effort or activity is not labor. Labor as an economic resource includes only that part of effort delivered between 8 a.m. and 5 p.m. during those years in which the laborer is an active participant in the labor force. Once a laborer reaches retirement, the investment in the laborer evaporates and he is no longer a factor of production. He is a residual. Economists have not yet come to grips with the dissipation of human capital but it is quite clear that a road and transport system designed to move workers to other factors will not be the same as a transport system designed to attend to the needs of an aging, infirm, and sometimes handicapped population. If expired labor is to receive help in maintaining its mobility, that help will most likely be justified on non-economic grounds—grounds that are especially hard to conceptualize and evaluate at this time.

The problem is particularly acute in rural areas. In the early years of settlement, rural residents made a conscious choice. They could cluster in villages and make daily trips to the land or they could settle directly on the land and make infrequent trips to the village or more distant places to obtain inputs and divest themselves of products. Settling on the land made more sense because it reduced the time required to get to their work. The infrequent trips away from the farm could be delayed or moved forward so "all-weather" roads were not needed. A loose net of secondary and tertiary roads sprang up in rural areas, but these ordinarily connected two towns and only tangentially came close to farm settlements.

Technical change in agriculture forced other kinds of changes on the industry and on the towns that served it. The nature of technical change forced farm enlargement and required the substitution of capital for labor. The labor that could leave agriculture did, but that without alternatives remained in place—left with little to do, no place to go and no way to get there. The communities were left with fewer people so all service diminished in quantity and quality. The doctors and lawyers and accountants fled to the next larger towns soon to be followed by the storekeepers, barbers and repairmen. These changes in turn required a rethinking of transport and mobility systems—a rethinking that has been started but is only partially underway. The rethinking has been inhibited by a large block of capital that is already sunk in a rigid network of roads and their accompanying facilities. The plaintive admonition that sunk costs should not be considered in decision making seems to have escaped many people interested in transportation.

## FIXED AND VARIABLE COSTS

There is no doubt that costs have an important impact on any present or anticipated transportation scheme. Many improvements in mobility have been justified on the basis of their capacity to reduce the costs of bringing factors together. Costs have also been important in setting rates on existing modes, deciding when new modes should be used, and in effectuating abandonment of some parts of mobility networks.

The costs of transportation represents an interesting set of problems related to distribution, efficiency, and equity. Leaving aside the railroads, which ordinarily won rights-of-way and all the appurtenant capital, the several modes of transport available to rural people represent a mix of public and private costs. Through the years the rural transport system has been expanded by extending or improving the fixed plant.

In the case of roads, additions to fixed costs can be used to lower variable costs. Improved roads mean less wear and tear on vehicles and lower (private) operating costs. Incurring public costs saves private costs but it means that the most popular vehicles are very demanding: they require good roads. The choice to transfer costs to the public has provided a lock-step arrangement whereby good roads lead to sensitive vehicles that incur high private costs when not used on hard surfaced, carefully sloped roads. Better roads bring costly, sophisticated machines that in turn require still more road improvements. So long as each round of new roads is publicly financed, no one seems to care.

The possibility of improving transport by providing more durable machines is not often considered. Storms isolate people because roads become impassable. It seems just as reasonable to improve the vehicle by increasing its road clearance, giving it swamp-buggy tires and making all four wheels (if there are four wheels) do double duty in steering and driving. Such vehicles have the important advantage of being mobile. Unlike a road, they can be sold and reused in a new location thus providing an important element of capital mobility in the already capital intensive activity of moving people from place to place. If such vehicles are costly (as they surely would be) the costs now used for road construction could be directed into subsidies for the machines that travel the roads. The total cost of transport may not be lowered but the vehicle subsidy has an important advantage: the vehicle is not fixed in space. It does not force such a severe irreversibility on the consuming public.

Our collective success in transferring road costs to the public has brought the disadvantages of two rigidities. First, the public's investment is long term and immobile. Its opportunity value is zero. Second, by shifting fixed costs to the public, we have insisted that each person make a significant financial commitment to a vehicle. The former problem has implications for long run efficiency in resource use. The latter problem has its own efficiency implications, but it also presupposes that all rural people have access to a useable vehicle—an assumption that will become increasingly difficult to live with as the years go by.

## MOVING THINGS OR PEOPLE?

The Sears catalog was a good idea. Not only did it provide the function of bringing buyers and sellers together, it also filled a role as "wish book"—it provided the opportunity for people to enjoy vicariously a range of choices that no mortal could possibly have. It substituted for mobility. Sadly, the Sears catalog became obsolete primarily because people gained mobility and did not need to depend upon the book for marketing or for diversion. The occasional trip to the general store, then the weekly trip to town, and finally the daily trip or the trip that occurs on call brought buyers and sellers together. People's increasing mobility allowed or even forced the concentration and subsequent immobility of industry and commerce.

For many years this concentration of activity was viewed as a good thing and was justified on the basis of more intense use of capital and the external benefits stemming from agglomeration. Now that it is recognized that many immobile people, who may have been mobile at the time of industrial and commercial concentration, live in rural areas and that more may be moving to rural areas, the suspicion is coming that concentration of capital and labor may have gone too far. Nowhere is this more apparent than in the "helping professions"—medicine, dentistry, the legal profession, and the like.

Those in the helping professions have clustered and in doing so have availed themselves of economies of scale, the shared use of specialized capital, and very high incomes. It is their incomes that provide clues to mobility problems. Physicians and lawyers become wealthy because they have necessary services to sell—the demand, regardless of how that demand is created, is inelastic. The inelastic demand coupled with the sharing of facilities has made the incomes of physician's very high. This high income has led to the argument that the physician's time is so valuable that he cannot afford to spend time travelling from patient to patient. His customers must come to him. Because a steady stream of customers is always available in the waiting room, incomes goes still higher adding even more justification to the idea that the inputs to a medical practice—that is, the patients—must be brought to the doctor rather than having the doctor go to the patients (inputs). The physician, even in a "well-doctored" area enjoys a spatial monopoly and forces others to cope with the problem of time and distance. One is tempted to expand the question: Could farmers or teachers or researchers or retail businessmen be as productive as physicians if they, too, could overcome the problem of time and space and have all the needed inputs brought to them?

The question is not idle nor is it a critical commentary on those in the helping professions. It is opened only to lead to a further point. Mobility is required to bring people and services together. For a number of complex reasons, this society has decided to immobilize some services and force the users to come to them. The immobilization has been "economic" but it has transferred income from one group to another.

There is no good reason why many services cannot be made mobile. Doctors and clinics can be put on wheels; dentists, lawyers, and libraries can be similarly mobilized. Admittedly, such mobilization brings costs and would change income distributions, but if society's goal is to improve access, the idea of

always moving people to capital must be sacrificed. In some instances it will be easier and more convenient for the consumer if the service itself is moved. A Sears catalog for appendectomies cannot be developed, but a mobile van with minor surgery capability can. This is not suggested as a perfect substitute for doctors' offices and hospitals that are fixed in space. Rather, it is suggested as an alternative means of improving mobility and as an alternative to the customary way of arranging capital facilities.

For all of this society's ingenuity, it has been inflexible on some points. One is on who should move which way? The question has many answers—but researchers have often opted for the safe, unimaginative route and have confined their inquiries to simple improvement of existing modes.

## A RESEARCH PLAN

The record of success in transport related social science research is a spotty one. Much has been done regarding the economics of mass transit, the effects of transport on development, the effects of transportation on land values, and the benefits and costs of highway improvements. Very little of this research has brought advances in economic theory and even less has provided the basis for transportation policy. In fact, most of the state and national policy relating to personal transportation has developed without reference to research. The boldest modern policy step in the field of personal transport was the 1974 reduction in the speed limit to 55 MPH. No research was needed for this policy. At the time, the nation needed to conserve fuel and all drivers who keep even modest records already knew that slowing from 75 MPH to 55 MPH saves fuel. Legislators turned common knowledge into law.

If researchers have such a poor record of influencing events and policy, they have a magnificent opportunity. Since no one has paid much attention to past work, it can be redirected without doing a disservice to the researchers' constituents. This is not to say that research in personal transport is not additive—indeed it is. This only says that no one is watching what we now do and we may as well take rather drastic steps into new and innovative lines of research. With the opportunity at hand, what should be done? Five things come to mind.

1. First, researchers dealing with moving people in rural areas must become increasingly cognizant of the fact that most elements of the transport system are public goods. The system or subparts of it can be used simultaneously by many people and use by one person does not preclude use by another. Moreover, even though use of the facilities is quite great and the need for it is quite high, it is impractical to collect revenues in all except the most peculiar and most specialized cases. These characteristics themselves cause the market for transport and mobility to fail and mean that signals regarding allocation and efficiency are weak if they are present at all. Traditional means of research must be sacrificed and the public choice approach must be taken to solving problems in the transport sector. Those involved in this activity must pay heed to forms of administration, the idea of alternative cost, the rates of substitution between various modes of transport and between transport and other public goods. An increasing number of agricultural economists are turning attention to public choice themes, but most who use this appraoch are involved in health care, education, and welfare programs. The transfer to transportation and mobility themes should not be overly difficult.

2. Following from the "publicness" of most transport-related themes is the general weakness of the technical concept of demand. Demand relates to a schedule of prices and the accompanying list of quantities sold. If no price exists, the concept loses its incisiveness. Since prices are not charged for most services included in the rural mobility net, it seems futile to concentrate research effort on demand. Demand studies may be very useful in analyzing the commuter trains running into central cities and in analyzing the availability and utilization of airplane seats between Denver and New Orleans. They are not particularly useful in helping to answer questions relating to the need for transport in rural areas. Determining how much can be paid or how much would be paid becomes a rhetorical question with little value in answering problems related to allocation or pricing. Society increasingly acts to provide meritorious wants for rural areas. The basis for satisfying these wants is not demand as the economist knows it and it seems foolish to impose such a rigid research commitment on scholars working in the field.

3. In place of the rigid notion of demand, we need more information of changing availability, changing needs, and desire. It is known that publicly-sponsored transportation is not generally available in the open countryside. It is also known that the availability of public transportation—buses, trains, and planes—has been diminishing in all but the largest towns. The extent of the decrease is not known. Nor is it known what subsidies would be required to restore public transport to levels available in 1930 or 1950.

It is strange that this research has not been carried out. An effort at Washington State University shows that in 1950, bus service was available to 606 towns and places. By 1975, 488 of these places had been dropped from the schedules. The places that lost service had average populations of less than 800 persons and were concentrated in the low income, remote parts of the state. We have not had time to estimate reduction in service to towns that remain in the system nor have we determined the total cost, public and private, of expanding routes to 1950 levels. This information seems vital if economists

are to learn how to make people of the state more mobile.

It should be noted that even this descriptive research is very expensive. Elaborate data processing schemes are required to turn a bus line's timetable into a research instrument. Even the crude question, "Is a town served or is it not served?" cannot be answered by bus line officials. Ferreting out the information takes time, patience, and research money. The investment of cash for these kinds of work seems necessary if we are to make sense of the availability of transportation in rural areas.

4. A fourth research theme deals with trade-offs and equity. Most transportation research has concentrated on efficiency and has been geared to getting people or things moved with the minimum time and resource cost. This general thrust has led to concentrating on limited ranges of technology and has encouraged the transfer of cost from private individuals to public bodies. The resulting kind of road system has aided in the transfer of income from one group to another. Here is where economists, *qua economists*, have their most difficult tasks. Equity is not a tidy issue. Economics has avoided it by depending upon the marginal conditions of maximum welfare and by ignoring the likes of Thorstein Veblen and John Kenneth Galbraith. Although most of us are willing to take normative stands on how much fertilizer should go to Iowa and how many peaches should be sold in New York City, we are reluctant to make a prescription that says the income of one group should be X dollars and the income of another group will be Y dollars. We are even reluctant to say that the income of one group should go down so the income of another group can go up. The recommendation stops with the somewhat listless suggestion that income be transferred from rich to poor. We are similarly disinclined to say that costs should be diverted from the impersonal public sphere to the very personal and highly voluble private sector.

Even though we refuse to deal in these kinds of problems, they are the ones that are most important when we discuss changes in the collection of social overhead capital and changes in the style of transportation. Any scheme that deviates from the get-them-there-faster-and-on-paved-roads approach to mobility has the potential of making significant changes in the distribution of costs and incomes. Research that shows the magnitude and/or the direction of possible transfer, has the potential of becoming a part of the decision and policy making process. It lists high in terms of cost and difficulty but the equity theme also lists high in terms of need and usefulness. The researcher who conducts a definitive study of the magnitude and incidence of costs and benefits of a new mode of transport or a new mobility scheme will have certainly increased his own mobility in the process.

5. Finally, transportation must be recognized for what it is: an intermediate product. With few exceptions, people move in space only so they can get to other things—other services, other markets, or into proximity with other people. As long as the movement has productive outcomes, its desirability is not questioned, but if the movement or the trip does not yield more tons of steel or more bushels of potatoes, the process has the potential of being overlooked. Researchers should examine the transport and productivity needs of four classes of people. (1) Those who are in the work force and self transporting, (2) those who are out of the work force because they need transport, (3) those who are out of the work force but are self transporting, and (4) those who are out of the work force and who cannot be expected to generate their own mobility. Each has separate requirements although their requirements are not necessarily exclusive. The last group is the most distressing. In the cold and dispassionate language of economics, these people are inputs in the production of many kinds of services. The services they help produce cannot be totally efficient unless these inputs can be made available. Treating people as inputs seems harsh but we need to know the effects these people have on the allocation of other resources and we need to know if making unproductive people more mobile will, on balance, increase or decrease the productivity of the nation's total stock of resources.

In sum, one wonders how Henry Ford is reacting to all this. He, after all, set out to make a car that was serviceable and that could be afforded by the average family. In succeeding, he imposed on the nation a frightful collection of problems. The car that he built gave people freedom and individuality. It diminsihed the need for whole sets of existing capital and required investment in new sets. It allowed service centers to develop and reduced the need for the door to door or route salesman. But most of all, it changed the whole way of living in the U.S. economy.

The Model T and its imitations came at a propitious moment. The nation was young and the people that lived in it were young, too. All that has changed. We are now a nation of people who grew up with the automobile and who have taken its freedoms for granted. But now we are a nation that includes people who have been by-passed by the automobile, the highway, and transportation. To date, no satisfactory substitute for the very personal automobile has been found.

It is foolish to ask for a return to horses and draught animals but it is not foolish to ask for innovation to accommodate the problems brought by the last 50 years in transportation growth. Can economists play a role? The answer to this is a tentative "Yes." They can if they begin to inquire into public goods, availability of services, substitutions, and equity. They cannot, I suspect, if they continue

to concentrate on qualities of roads, making rapid transit pay and studying the demand for long haul passenger service.

FOOTNOTE

[1]Some sections of this paper came from ideas generated in discussions with Donald A. West.

# Discussion

MR. WILLIAM MILLAR (Pennsylvania Department of Transportation): In your talk, Mr. Levine, you indicated that states should move very hesitantly into any program of subsidizing intercity bus carriers. Indeed, I think many of us in the room would agree that any decision to subsidize any sector is a decision not to be taken lightly. But I am somewhat concerned that many times we feel forced to get into subsidy situations. It may be that deregulation and some of the other things that you spoke of are useful activities and in the long run may have substantial benefits, but the political reality, at least in our state, seems to be that many people see service that they feel they need being withdrawn from the marketplace. They then require that actions be taken to preserve and in some cases improve that service.

I was wondering if you had any thoughts on how subsidies might be best administered and how they might do the least amount of damage, in the traditional economic sense. You spoke also to the point that there are probably alternatives to subsidy. Could you give us some idea what they might be in the short run?

MR. LEVINE: Offhand, I don't know of any subsidy program which is generated to meet short term critical needs of the people of a particular state. Let's say people want to go from Clearfield to Wilkes-Barre and they want to save the transit service on that route. I don't know of any standing subsidy program available to do that today. It must engender its own support and is likely to be a long-lived phenomenon. I think that one of the things we should attempt to do is to provide subsidies on a contract basis. Such contracts would provide very specific services for specific communities for a specific period of time, thus permitting us to evaluate exactly what we have at the end of a one-year or two-year period. That is one approach to the subsidy question.

As far as other things that might be done in the short term, it obviously requires legislative action to change drastically the regulatory environment in which these carriers operate. We are probably talking a two or three-year period. From my perspective, that is not an unusually long period of time to muddle through, if that is what it takes. In the interim, we should be looking at things like express stops for buses along the interstate system. If Greyhound, for example, doesn't want to run all through the Pennsylvania countryside, I am not about, as a policy maker, to force them to do so; if they think they can make money running across Interstate 80 and not detouring all over the countryside, fine, let them do it. Let them get out of that local service. Let's make it as easy as possible for any other operator to get in to local service but require them to tie into the trunk line bus operations at facilities along the interstate highway. That is another alternative.

A final one might be simply to open up the intercity bus industry to greater freedom of entry and exit in general and see what some of these other people out there can do who appear to be champing at the bit to get into that kind of service.

MS. MARY KIHL (Center for Appalachian Studies, University of Pittsburgh): My question is related primarily to the focus of Mr. Rupprecht's remarks. He seemed to be convinced, and I would agree with him also, that private mode transportation would obviously be the preferred means of people traveling around in the rural areas. However, I had difficulty relating to his carrying that one step forward and indicating that this means would also be possible for all the primary group of people living in rural America.

I wonder if perhaps his statistical analysis was one of the reasons for the discrepancy. He seemed to aggregate the material by dividing the United States into four basic regions and then indicating that across the four basic regions overall we did not have a shortage of private mode transportation. The same aggregation problem entered in when dealing with standard metropolitan statistical areas in which overall we do not have a problem as far as private mode transportation is concerned, but have we overlooked the real problem at the individual or small area level?

MR. RUPPRECHT: That is one of the problems with any presentation, the data aggregation that occurs. The census definition is SMSA and non-SMSA and that is becoming increasingly used for a broad analysis of problems. I think that Dr. Ira Kay has done an analysis on various counties in West Virginia. If one focuses on a county basis, one will find differences among areas in the accessibility to automobiles or even light trucks.

The purpose of the paper mainly was to show that there is approximately 85 percent of the occupied housing units that do have access to at least one

vehicle. I agree with you that in aggregation one tends to get lost in the forest and loses sight of the trees.

Definitional problems do exist and it might be better to look at a specific area, but I wanted to present the idea that the motor vehicle is the predominant mode in rural areas and not many people choose to use alternatives.

DR. KIDDER: Art Saltzman wanted a chance to answer the same question. I am going to allow him that privilege.

MR. SALTZMAN: There are a couple of other points I would make in the interpretation of the data. I think auto ownership in a rural area does not necessarily imply availability of a usable automobile. I think that has been very clear in our visits to the rural areas. If a car is there in the yard, that says very little about whether that car will be available on a regular basis for the prime driver. Let's point out that the prime driver, if he does happen to get the clunker rolling, eliminates potential use of the car by anyone else in the household.

I don't have any data to support what percent of rural disadvantaged families that own automobiles have them available for use by non-prime drivers, but I would guess it is a very significant portion that do not. We also have some pictures of some very beautiful cars out in the middle of the driveway, but if the census takers enumerated those cars as useful for transportation, it was a ridiculous mistake because you could see by the dust around the wheels that they hadn't been moved in a year.

Secondly, let me point out that Rupprecht's data was on autos per farm which obviously grossly inflates even though it was well stated and clear. But, I think the more relevant information would be autos per household as opposed to autos per farm household.

We have seen in our visits countless numbers of these small rural transit systems. I think that makes it very clear that there is demand from people needing public transportation services, and this is by no means a small portion of the rural population. Some 30 to 40 percent of the population is considered transportation disadvantaged in some way or other. Using that term transportation disadvantaged again creates a difficult conceptual problem because there is a whole range of transportation disadvantage, ranging from people who can't use a public transit system to those who can not for various reasons use a private transportation system.

For those who can't drive a private automobile there are other options such as getting a lift with neighbors. Unfortunately, some neighbors are not very neighborly. We found examples of people paying $25 to their friends to get in and out of town one day a month to get needed medical services. That is not an isolated example, but occurs in a number of situations. These people do have real problems. Some of these rural transit systems are starting to solve some of those problems.

MR. HARI MARHATTA (North Carolina A&T University): My question is related to the private automobile availability. Mr. Rupprecht said that the private automobile is economically feasible, and also available to 80 to 85 percent of the households, but I question the sample he obtained. That 80 to 85 percent might well be those who have accessibility to cars that are used for work purposes as well as for other purposes, but how about those other persons without access who might be located in very remote areas. Maybe they are retired and maybe they don't have any other sources of transportation. Now how could the private automobile be accessible as well as feasible for these people?

MR. RUPPRECHT: If I gave the impression that I wasn't concerned about the 15 to 20 percent of the people without access, that was not the intent of the paper. The questions are, what type of transportation will be feasible for them so that they can get around and have mobility; and secondly, will society decide to support that transportation. Essentially I think that to be used by those financially and physically able to operate automobiles, public transportation will have to provide a number of the characteristics that the automobile or the private vehicle presently provides, because people at this point, given a choice between waiting an hour for a bus or some vehicle to take them to a particular center of activity, may be willing to choose that one that requires no waiting.

DR. KIDDER: I feel that I have to inject something at this point, and that is that in fact society has made these decisions but they haven't made them through expenditures through the Department of Transportation or the Department of Agriculture, the two sponsors of this conference.

I am in the process of looking at expenditures for transportation among disadvantaged populations and non-urbanized areas and I find that the bulk of the money is coming out of the Department of Health, Education and Welfare, In fact, I think, Art, you were saying that it was about half a billion dollars, if you total it all up. I think what we have seen is the decline of bus services and the conventional methods, and these disadvantaged populations have turned to the political process to get the social service agencies to provide mobility, with substantial local contributions alongside. We economists don't see what are the actual transportation choices made by the disadvantaged. In fact, they are developing many transportation systems, or depending upon taxis, at considerable cost.

We seem to have no difficulty justifying billions of dollars for the development of subway systems in urban areas on the theory that this will promote the economic health of the community at large and that this is a necessary public expenditure. Somehow or other we have in our minds that an urban capital

infrastructure investment is a worthwhile public decision. We have made these public decisions, right or wrong, and we will probably continue to do so.

We don't see a similar kind of public investment in a structure in rural areas, and what we find is a proliferation of social service agency expenditures, a proliferation of agency approaches, and considerable dollars being expended on behalf of these client populations.

I think the suggestion that was made about subsidy this morning is very ingenious. It has been made before. In fact, in a 1968 conference on poverty and mobility the suggestion was made simply to subsidize the private vehicle directly. I think we are not prepared to make those kinds of direct subsidies to private ownership, but where you do have the commitment to mobility is through social service agency programs. I would urge that another conference be pulled together that would tap into some of this kind of expertise that is being developed out of other branches of government.

MR. PETER CANGA (Texas Department of Community Affairs): In this transportation for the disadvantaged, a new development has occurred and that is the high cost of insurance for the operators. Would anybody on the panel have a solution to that or at least suggestions as to what can be done?

MR. SALTZMAN: I suppose you are looking at me since I have been in the main focus of that. I think you may have found that problem in Texas and maybe Pennsylvania although it has been a very spotty situation. It is spotty because we don't have enough operating data on the incidence of accidents involving such operations and therefore the insurance companies make sure that they don't lose a lot from accidents.

Of course, part of the insurance problem is that the small social service agency delivery systems are not regulated by any public utility commission. They have usually been ruled outside of the transit domain and therefore they are independent to operate as they choose. That then presents an insurance problem. If they were inside the public utility commission domain, there would be other problems but I think that would tend to decrease the insurance problem.

I don't think there is an easy solution except to make the accident data more available to insurance companies so they will have more realistic estimates of what it really costs.

MR. WILLIAM MILLAR (Pennsylvania Department of Transportation): I would just like to make a quick comment on that. Yes, we have experienced some problems in that area and there seem to be a couple of things that you need to look at.

First of all, I would agree with your comment that insurance companies don't know what rural transportation is and as long as it was in the social service sphere, there was not a great deal of problem in getting insurance. A lot of times the social service agencies would get the same insurance rate for a van as for a private automobile, so it would be typically, say, a couple of hundred dollars a year. With development of an interest in taking nonwelfare or otherwise ineligible clients and also beginning to charge for some trips, many of the insurance companies took a closer look at those systems and concluded they were running a transit service and therefore were going to charge transit company rates. You find a lot of mixture that way.

I know of a six-county area in Pennsylvania where the transit authority pays $3,900 per vehicle per year for insurance, while the human resources agency in the area paid $300 for the same vehicles carrying the same clients before the transit authority was formed. Just the name change made the difference.

However, there is a more important factor that seems to be developing in Pennsylvania and other states and that is no-fault insurance, where the trail of liability follows the vehicle and not the person. There is a feeling among insurance agencies, at least in Pennsylvania, that vehicles that carry large numbers of people, relative to the private automobile, require more coverage to guard against potential loss. One suggestion I would have, which is something we are trying to do in Pennsylvania, is to work with your state insurance commissioner examining any no-fault legislation in the hopper at the moment. Try to look at what the effects are going to be and see if there are ways of building into that legislation some protection so you don't get hit with very large costs.

It is a major problem in more than just a few states.

MR. LLOYD C. HALVORSON (Cooperative State Research Service, USDA): It seems to me that there has been an assumption here that society has an obligation to provide people with transportation regardless of where they choose to live, and even if it has to be subsidized. Now I think that we also have to consider whether or not people can afford to live where they want to live, without regard to their own state of health. Typically in this country, rural people retire, live where they are for a while, and then they move to town because they don't like to drive their cars long distances anymore. After a while, when they can't drive their cars at all, they may move even closer to the business district or they may go into an old folks' home.

Now I want to ask Dr. Barkley as to how he would build into his calculus the obligation of people to move to places where they don't require a big subsidy.

DR. BARKLEY: I messed around with that theme in anticipation of the question coming up as indeed it has. The fact of the matter is that we as a nation are much shorter on housing than we are on transportation, and there is no place for people to go. You can't drag those folks in from the farm or from the reservation or from wherever until you build more housing, and then it becomes a very tidy economic question, is it cheaper to keep them out

there and go out and get them each day, or is it cheaper to build houses and congregate them.

Now that is a researchable issue and I would welcome the opportunity to look into the question.

MS. JOYCE JOHNSON (North Carolina A&T): I just wanted to add another factor. The gentleman said people move into town, you know, the business district. I think you might also investigate the dispersement of downtown areas because people are moving to downtown and downtown has moved out, so that the services are no longer there.

MR. LANCE CELMINS (Greyhoud Bus Line): I would like to direct a question to Arnold Levine and the question is, what are the factors and what source of data do you have which would support the seemingly unique characteristic that bus transportation services to small urban and rural areas suffer from diseconomies of scale. I think you made a suggestion that in the bus transportation area, we don't experience economies of scale.

MR. LEVINE: I relied on data from the Interstate Commerce Commission and examined operating statistics for some 50 Class I operators over a five-year period, 1970–1975, when there was a consistent accounting basis being used, and used the measure, operating expense per bus mile. There are some problems with that. As you well know, the Interstate Commerce Commission does not require separate expense accounting for the various types of services offered by the intercity bus industry. To that extent it is rather over-generalized.

What I found, however, was that within a relatively narrow band of output measured by bus miles, and we are talking in the region of maybe three to ten million bus miles per year, we have approximately 30 to 40 Class I carriers and they exhibit a rather wide range of operating characteristics which are dependent primarily upon where the operator is offering service. Obviously, operating expenses in the Northeast are considerably higher than in other parts of the country.

What does fall out of that analysis is that Greyhound—and by that I don't mean to hold up Greyhound as a poor example—operates at approximately $1.25 per bus mile. Many of the Continental Trailways affiliates operate in a similar range, especially those operating in the Northeast, and smaller firms who for one reason or another are not supporting large terminal facilities, who are not employing union labor, who are not buying new buses every eight years, are able to offer that same or similar service at three-fourths to one-half the cost.

Now that doesn't directly get at the specific issue of service to rural areas, but I suggest that the kinds of firms who might offer service to rural areas would be those who exhibit lower cost characteristics.

MR. MARK JELAVICH (Jack Faucett Associates): This is just a methodological comment, but there has been discussion throughout the past two days that urban problems are rather distinct from rural problems, to the point where some people have almost regarded it as a dichotomy of problems. I would like to point out that as far as small area bus transportation systems go, there have been some experiments done in cities and large urban areas where they have tried to develop demand responsive systems. I am familiar with some work that some colleagues of mine in graduate school did in Baltimore. The clienteles served in that case are similar, all being disadvantaged people and involved in non-work purpose trips. There may be something to be gleaned from these studies for rural transportation problems.

MR. SALTZMAN: Well, as I pointed out, demand responsive transportation systems in either urban or small urban areas usually are run by transit operators, and this is quite a different orientation than the one I have been discussing in most of my comments. That is not to say that there is not in addition a human service agency transportation system within the urban area. I think there are very large differences in effect in the way you can treat transit in urban and rural areas because of population density. You can't avoid that problem, and that is why I have suggested that my social welfare function, and I know that we probably have some disagreements as to the appropriateness of my social welfare function, is to provide services in rural areas as well as in urban areas. If it means that you need transportation to link people with human services, then the cost of providing it usually is reasonable compared with the cost of not having clients get to the services at all.

I think I have only partially answered your question, but I think there is a difference between the urban and rural settings, at least with respect to public transportation.

DR. KIDDER: It may be instructive to know that $500 million of Urban Mass Transit Administration money is available for proposals to be submitted for public transportation in non-urbanized areas. I think that the number of proposals in the queue is smaller than for urban area programs. I would relate this to the point I made earlier that the expertise in planning and responding to opportunities for grants is more in the urban area than in the non-urban area. I would hope that people with an interest in the rural areas would become familiar with these opportunities and transmit proposals for what they perceive as the critical problems.

There are a great many populations, a great many different kinds of rural areas, and so it requires, as Art said earlier, a more individualized treatment. If the expertise is not there to handle this individualized treatment, then we don't get the needs translated into actions. That is something I would hope would come out of this conference.

MR. ROBERT FETTER (Southern Railway Company): I ask this question as a former inveterate hitch-hiker and also one who continues to pick up

people along the road. I think Arnold Levine made reference to the possible value of pick-up stations or extra stops for buses. It seems to me that there is room for some research as to how hitch-hiking could be expedited with pick-up and drop-off stations and very elementary practices that get over into the licensing of hitch-hikers, if anybody is worried. You know, if you can wear a duck stamp on the back of your jacket, you could wear your hitch-hiker's license there, too.

In Poland they do license hitch-hikers and they give awards to those families who give the most rides over the course of a year. It also involves, having done 55,000 miles of it myself, an income redistribution element at a time when often we need that money! It seems to me that this is an area that might receive some research attention.

MR. SALTZMAN; There has been little research done on this hitch-hiking opportunity. It was done at the University of Colorado by Ken Dahlmeyer. Fort Collins, Colorado, has a system somewhat like you suggest. I haven't heard if it still exists or doesn't. I haven't noted any other research funded by the DOT in hitch-hiking.

Of course, it is another form of what we call the para-transit mode, a very difficult one in which to do any research. However, I think it is certainly justified.

**Congressman Bill Alexander gives keynote address—others in view are Bob Bruton (Chairman of Keynote Session), Reid Grigsby and Ed Tyrchniewicz**

Five members of the Planning Committee and Staff—Bill Brown, Ken Casavant, Joe Gerald, Inez Sletta and Jerry Hammond

# Luncheon Keynote Address Transportation Policy: A Legacy of Chaos or Survival

William V. Alexander
U.S. Congressman from State of Arkansas

New Orleans is a fine, lovely, old, historic city. It is an exciting place to visit. Nevertheless, I often wonder if it would not be more appropriate for meetings like this one to be held in one of our beautifully scenic, but isolated and transportation poor countryside areas.

That way, instead of speeding from an international airport to the conference site over sophisticated expressways and impressive thoroughfares, the conferees could meander from the airport to the conference site over winding and frequently inadequate primary and secondary highways.

That experience would help to forcefully focus attention of all conference participants on the problems facing us.

Transportation systems—highways, railroads, inland waterways, airways—are like pieces of a jigsaw puzzle. Put them together in the right combination and they make a balanced national transportation policy the way a jigsaw puzzle makes sense.

During the past four years we have witnessed an Administration proposing and Congress acting on major changes in Federal policy toward all these transportation systems. These proposals and changes have rushed us toward the future with little real progress toward establishment of a national transportation policy and with apparently little grasp of the over-all impact of these changes.

Continued failure to put together a reasonable, long-range balanced national transportation policy in which rural transportation is a full partner is inviting economic catastrophe.

I don't say that none of the changes in federal transportation policy should have been made. I do say that they should not have been made in the atmosphere of "I-don't-knowism" that has surrounded them.

For instance, during the past two years we have seen:

—the completion of a federal aid highway system realignment that cut more than 37 percent of the rural secondary highway mileage off the federal-aid system and increased the eligible urban highway mileage by 671 percent;

—the adoption of a federal aid highway law that not only effectively cut the funding for non-Interstate highway systems but which opened up the $200 million "off-system roads" program for rural highways to use by big cities without an increase in funding; and

—the adoption and beginnings of implementation of a major railroad program that will inevitably result in more railroad abandonments in countryside areas.

These developments have taken place despite the fact that the Department of Transportation knew that at least 34,700 of the nation's bridges—most of them in rural areas—are so inadequate they must be replaced. It has happened despite the Department of Transportation's knowledge that 84 percent of all rural road mileage is inadequate to meet the needs of the areas they serve and that most of the 43,307 miles of rail road abandoned since 1938 was located in the countryside. In addition to these problems, outmoded, wasteful practices and government regulations result in the trucks on our highways running empty 40 percent of the time and our rail cars moving products only 10 percent of the time.

I asked the U.S. Departments of Transportation and Agriculture to tell me what this policy combination will cost farmers and consumers. Boiled down to three words the answers I got were "we don't know."

That is the reason I am here. It raises my optimism to know that there is a possibility of closer cooperation between the Department of Transportation and Agriculture, between the leaders of the transportation and the agricultural industries.

We need and must achieve a better understanding and better, closer working relationships between transportation and agricultural policymakers.

Food is America's most important product.

Both the stability and security of our society and the economics of our Nation hang heavily on the availability of sufficient food supplies to satisfy the needs of our own people and to respond to foreign market demand.

Our Nation is blessed with about 50 percent of the tillable land on earth. We are one of the few nations that can supply its own food needs and help supply the needs of the hungry people of other nations.

It has been the ability and willingness of the Nation's farmers to increase their production that has kept our Nation from sinking into a sea of red ink created by rising imported oil bills. Since 1972, for instance, the value of agricultural exports have more than doubled—moving from $9.4 billion to approximately $22 billion.

Food is grown where the land is productive and there is no strong relationship between these areas and the geographic location of the ultimate consumer. Thus, agriculture is more dependent on transportation than almost any other part of our economy.

A full food production policy will not work without an effective and efficient transportation policy.

Despite our food production and distribution system's dependence on transportation there has been a steady decline, in terms of 1967 constant dollars, in the investment in rural transportation. In addition, pressure has been growing in the Administration and in the Congress to make deep cuts in federal aid to inland waterways over which millions of tons of food move every year.

The simple truth is that through short-sightedness in national transportation planning and federal resource allocation we are in danger of destroying crucial links in the transportation system essential to exploitation of our food production potential.

Most of our Nation's farmers have no direct access to railway transportation. Even if they did, rail industry and federal transportation experts frankly admit that recent federal rail legislation is heading in the direction of increased abandonment of rail lines still serving rural areas.

Through this rail policy we are steadily hacking away at what was once one of the basic links in the food production and distribution system. At the same time, through our highway policy we are perilously close to giving the remaining link, rural highways and roads, a mighty shove toward oblivion.

If the downhill slide of our already dangerously deficient rural highway and road system is allowed to continue these things will inevitably take place. Our food production will be crippled for lack of adequate transportation. Our farmers, whose activity generates more jobs directly and indirectly than any other single segment of our economy, will have to sharply curtail their operations. Retail food prices will take another ride on a skyrocket named "Transportation Costs." And, even more people will die or be irreparably harmed by the effects of malnutrition and starvation.

True—the federal budget needs restraint.

True—part of the burden for that restraint must be borne by transportation programs.

True—we need efficient, reasonably priced mass transportation for the teeming millions of our great cities.

But, what a legacy of disaster we will build for those city-living men, women, and children if the price of mass transportation is taken out of the dollars needed for shoring up and improving rural highways and roads essential to food production and distribution.

Failure to reverse the federal trends of neglect and withdrawal from the rural transportation field carries with it the seeds of a food disaster.

Yet, when we seek answers from DOT and USDA about the ultimate effect on our food system of these policies we are told that they don't have the answers.

Countryside regions and food production are too important to our Nation's survival for us to continue to take the risks of blind policy making and muddling through hoping for the best.

There are a number of essential transportation policy actions that I believe we must and can accomplish.

We must write into federal law a commitment to a balanced national transportation policy that makes rural transportation a full partner in transportation planning and development and that makes the most effective and efficient use of modes of transportation available to us.

We must create within the Congress a better understanding of the importance the state of rural transportation has for the cities.

We must push for the appointment of experts with practical experience and a sympathetic understanding of rural transportation problems to major policy making positions within the Department of Transportation.

We must encourage and insist on the U.S. Department of Transportation and other transportation agencies working closely and cooperatively with the U.S. Department of Agriculture in the formulation of transportation policies.

We must work for and develop transportation programs that are expressly designed to respond to the problems that are unique to rural transportation.

We must insist that before major transportation policy changes are made sufficient research is carried out to provide adequate answers to what effect the changes will have on all relevant transportation modes, on the economy of the Nation, and on the economics of essential industries such as agriculture.

Time is running out for responding to the transportation issues you are examining at this symposium. As the clock runs the cost of recovering from the mistakes we have already made in transportation policy continue to rise.

Rural transportation is in a state of crisis.

How we treat transportation policy—particularly rural transportation policy—will mean the difference between a legacy of chaos and disaster and a legacy of survival and progress.

In the past the American genius, optimism and will to do has repeatedly snatched us off the knife-edge of disaster. I am convinced that it can do so again. And, that this symposium today has the potential to be a key to move on our road to success.

**Congressman Bill Alexander makes a keynote point**

# Discussion

MR. BRUTON: Thank you very much, Congressman.

Congressman Alexander has consented to answer questions from the audience.

MR. EDWARD C. SULLIVAN (University of California): Highway funding, of course, has in recent history been based on the gas tax as a source of funding and without enormous explicit cross-subsidies, one will then tend to have investment in the roads to the extent that the roads carry a lot of traffic because those are the roads that are generating lots of gas tax revenues.

I was wondering what alternatives to this source of funding might be being bandied about in Washington in order to come to grips with the fact that you need heavy investment in some of these roads that aren't carrying so much traffic.

CONGRESSMAN ALEXANDER: The biggest problem that we have in the Congress is that all the boys in the big cities have found out about the Highway Trust Fund. So the last four to six years, we were building up these lines of defenses to ward off the onslaught. We know where the votes are, and once they discovered where the Trust Fund was, you know what happened. There are no specific proposals ongoing at this moment, to my knowledge, which would provide the funds necessary to do the job that needs to be done. The one exception that I must allude to that keeps hanging around the Department of Transportation is to put a user tax on the waterways. This would add some monies to the budget which would actually be used to replace the direct appropriations for the Corps of Engineers and for navigational work. It would free up that amount of money that could be used for highway construction or for some other transportation purpose.

I for one am willing to consider a gas tax if that tax is going to be used to resolve our transportation

needs. I am the author of the amendment that struck a gas tax increase from a 1975 energy bill. The bill's supporters were saying we need to authorize up to 23 cents a gallon tax on gasoline and diesel fuel in order to encourage people to use mass transportation. I said, "Have you ever heard of anybody catching a subway in Osceola, Arkansas, or a rapid rail transit train in Bug Tussle, Oklahoma?" You know, we don't have any mass transit. The biggest thing we have got out in Osceola, Arkansas, and Bug Tussle, Oklahoma, is like an eight-passenger Dodge van.

I prevailed and because the gas tax discriminated against people living in non-metropolitan areas. But, certainly I would consider a gasoline tax or a fuel tax if that tax were going to be used to resolve our transportation needs.

Being a sort of political fundamentalist, I realize that if you are going to dance you have got to pay the fiddler. If we are going to develop a national transportation policy over a long range period of time—you can call it a 50-year plan or a five-year plan, it doesn't matter to me as long as it is comprehensive—then you have got to pay for it. I think that any plan should be accommodated by a tax bill to pay for it.

MR. PETER CANGA (Texas Department of Community Affairs): In 1974 in the case of *Smith vs. Vowell* the federal judge decreed that if the people that are supposed to receive services under the different laws were not provided transportation, the agencies were not complying with the law. Therefore, the State of Texas is now providing transportation for Medicare patients.

Is there anything contemplated to provide the transportation funds to comply with the law?

CONGRESSMAN ALEXANDER: I know of none at this time that would totally complement the decision from the Texas judge, if that decision were to be applied nationally, although we did appropriate some monies in the last Congress to apply toward the transportation of disadvantaged people, which monies could conceivably be used for the purpose of people who are receiving Medicare.

I might defer to Bob and ask if he knows the answer to that. Do you?

MR. BRUTON: No, I don't.

CONGRESSMAN ALEXANDER: I don't think there is any national plan to provide monies with which to fund transportation for Medicare patients.

MR. CANGA: I am not referring specifically to Medicare but there are other social services that are being served by community action agencies, and although there are some funds for capital equipment, there are no funds to speak of for operation and these systems in rural areas such as Texas where you have large expanses are very expensive, so any consideration for providing operating funds for para-transit systems by legislation certainly would help.

CONGRESSMAN ALEXANDER: I have two thoughts on that subject, if I must just hitch-hike a little further on an answer.

First of all, there are a number of national demonstration projects ongoing at this time, the findings from which will become a part of a recommendation to the Congress for a permanent solution.

The second thought that I have is that any recommendation should be a part of an overall comprehensive plan that would not be just a band-aid approach to the problem of providing transportation to the handicapped and to the disadvantaged.

DR. KENNETH L. CASAVANT (Washington State University): One of the objectives of our symposium is to identify research needs but an accompanying objective is to look at research that has been done and see if it is being provided in the fashion that is useful to the doers, not saying that we are not doers. When you look to the information available to you in the area of transportation and rural transportation, how do you evaluate our research and what kind of changes would you like to see from us?

CONGRESSMAN ALEXANDER: First of all, I think that some of the research that is done in the transportation field is very good and some of it is just awful. We have done a study in our own office of the grants that go out to various academic institutions for the purpose of conducting research. We discover what appears to be a very strong political prejudice present in many instances. That is all right if they are doing good work. I have no fault in that.

But, I think that the changes that should be made, to follow up on your second question, the quality of the work, the quality of the performance should be good no matter who does it, and that when it is done it should be done by someone who knows what they are doing. I just have in mind immediately a grant of $100,000 or $200,000 that DOT made to George Washington University to study rural transportation. I mean, do people in George Washington University know about rural transportation!

That is the type of inexcusable government waste that I have fought every day I have been in Congress. In fact, I think we ought to make that sort of decision more accountable to the people that throw away money like that because there is not that much to go around. I guess we do that every four years or eight years, as the case may be.

Does that answer your question?

DR. CASAVANT: Yes.

MR. NATHAN I. FINKELSTEIN (Office of Public Counsel, Interstate Commerce Commission): It seems that one of the only ways you are going to be able to retain rail service in rural areas with light density volume is through the use of operating subsidies. There seems to be an attitude both at the federal and state levels that long-term operating subsidies are not a viable option, although our experience in the Northeast region in holding

hearings has been the opposite as far as public response is concerned.

I was wondering what your attitude is on long-term operating subsidies and what ideas you have on circumventing the attitudes of some of the state and federal officials.

CONGRESSMAN ALEXANDER: Two or three thoughts on the subject in general. First of all, I don't know what to do with the railroads, either. But, in looking at the problem it is obvious to me that we are dealing with a problem that developed back in the early part of this century. We are allowing the tail to wag the dog.

There are some rail lines that need to be abandoned, that do not serve an economically viable function. At the same time there are rail lines that need to be built and expanded to meet the needs of the 1970's and '80's. The thing that bothers me is that when we come up with a solution it is always to resolve a problem that developed 30 years ago, it is not to plan for and provide a solution to a need that we have in the '70's and '80's.

I don't think there is anything magic about the railroads. You know, I don't have any emotion in dealing with the railroads unless those railroads can perform a vital service to our nation. If they perform a service and if that service is vital, then they may need to be subsidized. Some rail lines are more deserving than others. I think, to give you an additional thought, we can combine our unemployment problem with our railroad problem, especially when it comes to the roadbeds. Instead of paying that money out twice, once to the railroad companies and again to the people that are unemployed, I would say pay the money to the people that are unemployed to work on the railroad beds. That type of thing.

There is no simple solution but I think that we are looking backward at the problem rather than looking forward to a solution for the '70's and '80's.

MS. INEZ SLETTA (U.S. Department of Transportation): Congressman Alexander, based on your background and your concerted efforts in the whole area of rural transportation, what changes have you seen in the definition of rural transportation and the aims and what would be your views on, say, a national transportation policy effort, so that we have more intermodal transportation efforts being recognized?

CONGRESSMAN ALEXANDER: Thank you very much, Inez. That is a very good question. I would like to throw away the word rural entirely, with reference to this symposium, and I would like to throw away the word urban entirely and pick out two words that don't have the connotations that attach to the words rural and urban.

If you go out to Mountain View, Arkansas, and ask those people out there if they are rural, they are going to shake their heads, because most of them, you know, have been to school, a lot of them to college, they have traveled and they consider themselves to be a part of the urban society. The word rural carries with it a connotation that is so interrelated with agriculture and further so dominated by the thinking of the '20's and '30's that you have a whole set of prejudices to overcome before you ever reach the fundamental problem.

So, in our office in dealing with the problem of transportation, we talk about cities and the countryside and everything in between and we start out from there. I think that the fundamental problem that we have in formulating a national transportation policy, which we are beginning to do, boils down to about three separate areas.

I think one is political; the second one is, I would say, organizational. And, the third is probably what I would call emphasis or leadership. You have to look at where the votes are in this country if you are depending on passing appropriation bills or tax bills, and what we are talking about here is developing a policy and implementing that policy with money, with construction primarily.

In order to do that we cannot ignore the political weight that exists in our national government and in our state governments. Traditionally the political power base has been in the cities, and as we all know, that is moving. It is moving very rapidly and at some point between A and Z out here, it is likely to move away from the cities out here to the countryside. Some political analysts say that that took place in the November elections, although the people in New York don't think so, and neither do I because I think that if this is happening it is a gradual process.

So, we have to focus, we have to face up to the fact that the Department of Transportation and the Department of Housing and Urban Development are urban agencies in the old framework. The Department of Agriculture is a rural agency in the old context. When you have that sort of line-up in Washington it prevents you from dealing with the problem that transcends both.

That gets us into the organization explanation, which I have illustrated in the administration, and the same exists in the Congress.

Thirdly, I think the emphasis is not in the right place at this time because of the political and the organizational facts of life. There is an urban bias and there is a rural bias, or a rural prejudice, that exists in these various agencies that prevents a real meeting of the minds in trying to formulate a national policy.

I think we are beginning in the direction of that formulation here. I think we will continue to do so with organizational changes that will occur next year, both in the administration and in the Congress. I look forward to participating with all of you in accomplishing these things.

Yes, we have time for another couple of questions, about 10 minutes.

MR. LLOYD C. HALVORSON (Cooperative State Research Service, USDA): We know that

shortly after the Highway Trust Fund was created, urban interests were out to bust it. Now to what extent have they succeeded in diverting that highway user money to non-highway purposes and what are the chances of stopping that?

CONGRESSMAN ALEXANDER: Well, there are no chances of stopping it because it has already happened. As I understand what happened, the urban interests have a local option as to how to use their share of the Highway Trust monies, is that right, Bob?

MR. BRUTON: Yes.

CONGRESSMAN ALEXANDER: And, the determination of that option is a very complicated process that includes both local, county and state levels, in conjunction with the federal level. But it has already happened. They did "bust the trust," so to speak, and the question is how far beyond what they have already done will they go when the present authority expires. When is that, next year or the year after next? It was a three-year bill, I think, that we passed last year. We gave them a good fight on that, though. They knew they had been there.

MR. DAVID W. JOHNSON (U.S. Department of Transportation): I was just wondering, you mentioned the word organization. Do you have any feel for or ideas or thoughts on how perhaps either the administration will or what you would like to see done in terms of reorganizing the Department or if it even needs one to get a balanced transportation effort going?

CONGRESSMAN ALEXANDER: I can answer your second, I cannot the first. The morning paper said that the President-Elect had not made any choices for Cabinet positions and so I don't think we can even approach that first question.

I personally would like to see the establishment of a permanent agency within the Department of Transportation which we could pattern after the Australian agency. Call it whatever you like, countryside transportation agency, which would have the responsibility of bringing specialists on board that were sympathetic with the problem, that would have standing at Secretarial level meetings, that would have input to a White House staff meeting and ultimately to a Cabinet level meeting.

I think the problem here has been one of lack of emphasis, lack of understanding, inherent bias and prejudice on the parts of a lot of people, both industry and government as well as academia, that have obstructed the normal development of a national transportation policy. I think it is a very complicated and complex subject that is going to take some real heavy hitters to focus on it—maybe even the Presidential level, but certainly at the Secretarial level, in order to place the right emphasis—to say, "You know, we are one big country. We have got to throw away all these little prejudices we have, where we give operating subsidies to the subways in New York but we don't give them to the people in Texas for their Medicare patients." I think we are only beginning at this stage.

Incidentally, I have a transportation problem myself, beginning in about five minutes, so if we can limit our discussion.

MR. JOHN PHIPPS (Caterpillar Tractor): I also come from Australia and I have found your comments very refreshing. I would ask just three brief questions.

Firstly, recently President Ford set up a national transportation study committee of 19 members, which did include some combination of industry people and parliamentary officials. Could you make some comment on whether you thought that was being effective and what can be learned from it.

My second question was, I do believe there was legislation introduced toward the end of the last Congress, attempting to increase the primary highway allocation from $1.25 billion to $3.5 billion and reducing the matching funds. It died in the House. I think it was introduced by Representative Bob Jones. I was wondering if that had any chance of being reintroduced in the year of 1977.

My final question was, what sort of things do you see that people in industry like our company can do to help the transportation situation in the long term?

CONGRESSMAN ALEXANDER: To answer your second question first, I don't know that the Jones' bill was ever intended to reach final law. I think it was what we call an end-run in Congress, to try to get the attention of some well-meaning but misguided Senators over across the Hill for the purpose of establishing what we call an exchange in conference.

With reference to your last question, I think that private industry must become a part of this whole process, and certainly your company, the presence of your company in any sort of policymaking stages of development would be welcomed and you would have something to say.

On your first question, I do not know the status of the President's commission. I don't know anyone on it. I don't know what they have been doing. I am sure that they will produce some recommendations which will be valuable, but I have been preoccupied with getting re-elected the last couple of months. (Laughter)

Thank you very much.

MR. BRUTON: Thank you again, Congressman Alexander, both for myself and for the organization committee and for everyone here. It is very nice for all of us to know that we have a friend on the Hill and I hope the research we do and the work we do in the Department is helpful to you.

# Session D: The Economics of Freight Transportation in Low-Density Rural Areas

Edward W. Tyrchniewicz, *Moderator*
Professor of Agricultural Economics
University of Manitoba

## OVERVIEW OF SESSION

The matter of freight transportation in low-density rural areas is a long standing problem, both in the U. S. as well as in Canada. Factors such as declining population, shifts in modal shipping patterns, rising costs and allegedly unresponsive regulatory practices have contributed to the complexity of the problem. The railways contend that they have been losing money on the operation of uneconomic branch lines and they prefer to abandon these. The users of the railway services, whether they be operators of grain elevators or other rural users, are concerned about the impact of abandonment but at the same time they are concerned with the deteriorating quality of service of transportation.

Rural communities and rural citizens are also concerned that the abandonment of branch lines may sound the death knell for many such communities. State and county governments are concerned that with the abandonment of rail lines there will be additional tax burdens shifted onto local governments and there will be needs for road improvement.

Superimposed upon all of these concerns is the uncertainty as to what is going to happen in the future, especially in terms of government programs, government policies, and when they will be enacted. Happily, or unhappily as might be the case for some people, a number of things have been happening in the area of transportation policy in the U. S. The enactment of the Regional Rail Reorganization Act of 1973 and the Railroad Revitalization and Regulatory Reform Act of 1976 have been two examples of some of the movements in the direction of changing policy.

In this afternoon session of the symposium we are going to look specifically at some of the effects of rail line abandonment, particularly the economic effects, and the economics of rural road investment. We have six fine papers which will explore a number of these different issues.

# The Potential for Rail-Service Termination on Non-ConRail Carriers

Herbert Weinblatt[1]
CONSAD Research Corporation

As most of you are aware, the Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act) and other recently enacted legislation contain provisions which can result in increased rates of abandonment by railroads of unprofitable branch lines, as well as provisions which will permit subsidies for continued service on many of these lines. The purpose of this legislation, of course, is to improve the financial health of the currently ailing railroad industry. However, any increase in the rate at which branch-line service is terminated can be expected to have side effects on the rest of the transport industry, on the present users of affected lines, and on the local economies of the predominantly rural areas served by these lines.

CONSAD Research Corporation, under contract to the Secretary's Office of the U.S. Department of Transportation, is presently attempting to learn more about the extent of some of these effects. In particular, we are developing estimates of the potential effects of railroad abandonment on:

- the freight transport system,
- transport costs of affected rail users,

- resulting public-sector and private-sector investment, and
- energy consumption.

The study which we are performing contains four major components. These are:

- a determination of the potential for rail-service termination;
- a survey of a sample of potentially affected rail users;
- analysis of survey responses to determine the various effects which rail-service termination would likely have; and
- expansion of the results of this analysis to the universe of all potentially affected rail users.

Estimates of the potential for rail-service termination have been developed. The rail-user survey is now nearly complete and many of the survey responses have been analyzed. The final results of the study, however, will not be available until early next year. This paper will therefore focus primarily on the one component of the study which has already been completed: the potential for rail-service termination.

## ESTIMATING THE POTENTIAL FOR RAIL-SERVICE TERMINATION

As of July 23, 1976, 221 petitions were pending before the Interstate Commerce Commission (ICC) requesting approval to terminate freight service on 5835 miles of railroad line. Some of these petitions will be denied; others represent service by one railroad on lines which will either continue to be served by another railroad or which will be taken over by another railroad if the petition is granted. However, in most of these cases, it is likely that the ICC will eventually approve termination of all service unless continuation subsidies are provided.

The potential for rail-service termination, however, extends beyond the lines on which petitions for abandonment are now pending. Substantial additional mileage is presently being operated unprofitably and could become the subject of future abandonment petitions. Although Section 802 of the 4R Act requires railroads to submit to the ICC a listing of lines which are "potentially subject to abandonment", these submissions will not be required until next May. For planning purposes it is necessary to estimate, before the railroads have submitted this information, the extent to which lines might become subject to abandonment.

In order to develop estimates of the total mileage of unprofitable lines, and of the traffic which originates and terminates on them, CONSAD performed a computerized analysis of available railroad network and traffic data. Preliminary results from this analysis were developed for 31 southern and western states on an accelerated schedule for inclusion in the Secretary's Report to Congress which was mandated by Section 904 of the 4R Act (3). These results have since been refined slightly and expanded to include the "non-ConRail carriers"(2) in the northeastern states.

The analysis was performed in three steps. First, the Federal Railroad Administration (FRA) preliminary network model (1 and 2) of the nation's railroad system was used to select a set of light-density line segments and to obtain the length of each segment. The network model represents the complete national railroad system except for some simplifications involving complex urban-area networks configurations.

The segments selected for analysis were those directly represented in the network model, served by a single carrier, and identified as carrying one million gross tons or less per year.[3] Because of the unavailability of data on terminating traffic for railroads with average annual operating revenues of less than $3 million, lines operated by such railroads were excluded from the analysis. Also excluded from analysis were all lines which had been formally abandoned as of July 23, 1976.

Next, estimates of the total amount of traffic originating and terminating on each light-density segment were obtained from the FRA Waybill Files for 1972, 1973 and 1974. This data represents a systematic one percent sample of audited revenue waybills for all domestic shipments terminated by railroads with annual operating revenues of $3 million or more. A three-year period was used to increase the size of the sample and to reduce the effect of the business cycle, weather, and other temporary influences on traffic volume.

Finally, each of the selected segments was tested for economic viability on the basis of the volume of traffic generated on the segment and the importance of the segment to mainline connectivity. To develop an appropriate viability criterion, CONSAD reviewed data published by the United States Railway Association (USRA) summarizing the results of their detailed financial analysis of the economic viability of 344 former Penn Central lines (5). Slightly less than half of these lines had passed USRA's viability requirement that they generate sufficient revenue to cover at least 90 percent of avoidable costs. From this data, a simple viability criterion was developed: Did the line originate and/or terminate an annual average of at least 70 carloads per mile?

For individual lines, this criterion classified approximately 90 percent of the lines in the same way as did USRA's detailed financial analysis. Moreover, the criterion produced an almost perfect estimate of the total number of lines found nonviable by USRA.[4] Although the 70-carload criterion is in no way an accurate substitute for a careful financial analysis of individual lines, it was found to provide a good indication of the total number of unprofitable lines. It was therefore used for this purpose in developing estimates of apparently uneconomic

mileage and of traffic originating and terminating on apparently uneconomic lines.

## THE EXTENT OF POTENTIAL RAIL-SERVICE TERMINATION

Data on the potential for rail-service termination by non-ConRail carriers is presented in Tables 1 through 5. The first table shows both the number of miles of line which are the subject of abandonment petitions which were before the ICC as of July 23, 1976, and the larger number of miles which appears, on the basis of the computer analysis, to be uneconomic and possibly subject to further abandonment proceedings. In the tables these two sets of lines are referred to, respectively as "lines with petitions pending" (or "PP lines") and "apparently uneconomic lines" (or "AU lines"). It may be observed that the mileage of the former set of lines represents only 20 percent of that of the apparently uneconomic lines.

The mileage data is displayed for seven regions. These regions are defined in Figure 1.[5] As indicated, the Northeast has the largest percentage of present mileage under petition for abandonment (5 percent of non-ConRail mileage in the region), while the West North Central Region has the largest percentage (26 percent) of present mileage which is apparently uneconomic. Even this percentage, however, is lower than the 28 percent of total active and out-of-service mileage excluded by USRA from its Final System Plan for the ConRail carriers (4). The South Atlantic and Mountain Regions have the smallest percentages of mileage with petitions pending, while the East South Central and South Atlantic Regions have the smallest percentages of apparently uneconomic mileage.

Estimates of the total volume of shipments originated and terminated annually on both sets of lines have been obtained from the FRA Waybill Files and are displayed by region in Table 2. Nationally, only about 0.12 percent of all railroad tonnage originates on lines with petitions pending, and an even smaller percentage is terminated on such lines. About 2.4 percent of all tonnage originates on apparently uneconomic lines, while less than one percent terminates on such lines. On a regional basis, the West North Central Region has the largest percentage of potentially affected traffic, with as much as 8 percent of all tonnage originating on apparently uneconomic lines, although only 0.4 percent originates on lines with petitions now pending.

The same estimates of potentially affected shipments are displayed by commodity in Tables 3 through 5. In Table 3, all commodities have been grouped into 13 major categories based on the Standard Transportation Commodity Codes. Since most lightly used lines are in rural areas, it is not surprising to find that a disproportionate part of the shipments on such lines are agriculturally or silviculturally related.

Table 1. Miles of lines with petitions pending and apparently uneconomic lines by region

| Region | Existing miles[1] | Lines with petitions pending | | Apparently uneconomic lines | |
|---|---|---|---|---|---|
| | | Miles[2] | Percent of existing miles | Miles[3] | Percent of existing miles |
| Northeast | 35,396[4] | 1,910 | 5.4% | 6,900 | 20% |
| South Atlantic | 16,664 | 188 | 1.1% | 1,000 | 6% |
| East South Central | 14,887 | 494 | 3.3% | 700 | 5% |
| West South Central | 25,492 | 915 | 3.6% | 3,400 | 13% |
| West North Central | 48,275 | 1,881 | 3.9% | 12,600 | 26% |
| Mountain | 20,157 | 226 | 1.1% | 3,400 | 17% |
| Pacific | 15,127 | 234 | 1.6% | 2,400 | 16% |
| Total | 175,998[4] | 5,848 | 3.3% | 30,400 | 17% |

[1]As of December 31, 1974. From Association of American Railroads, *Yearbook of Railroad Facts,* Washington, D.C., 1976; and *Moody's Transportation Manual,* Moody's Investors Service, New York, 1975.
[2]As of July 23, 1976. From Interstate Commerce Commission, Section of Case Control and Information, unpublished data.
[3]From computer analysis.
[4]Non-ConRail carriers only.

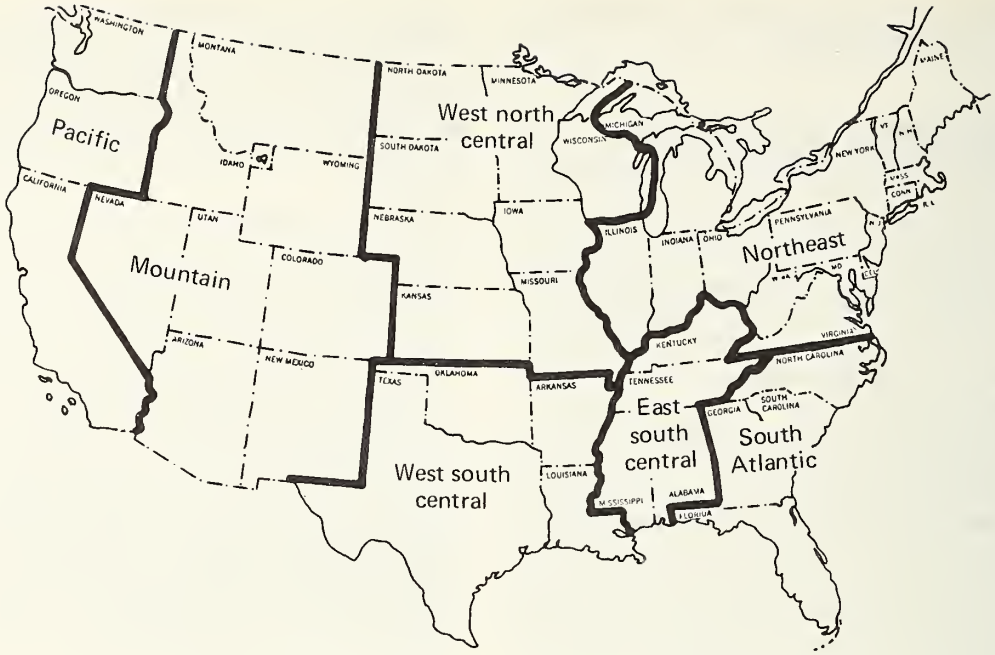


**Figure 1. Regions used in tables 1 and 2**

Table 2. Shipments originating or terminating on lines with petitions pending and apparently uneconomic lines, by region

| Region | Originations (millions of tons) | | | | | Terminations (millions of tons) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Regional Total[1] | On PP lines[2] | | On AU lines[3] | | Regional Total[1] | On PP lines[2] | | On AU lines[3] | |
| | | Total | Percent of reg. total | Total | Percent of reg. total | | Total | Percent of reg. total | Total | Percent of reg. total |
| Northeast | 516[4] | 0.5 | 0.1% | 3.9 | 0.8% | 545[4] | 0.4 | 0.1% | 2.2 | 0.4% |
| South Atlantic | 130 | -[5] | -[6] | 1.2 | 0.9% | 162 | -[5] | -[6] | 0.6 | 0.4% |
| East South Central | 147 | 0.2 | 0.1% | 0.8 | 0.5% | 108 | 0.1 | 0.1% | 0.4 | 0.4% |
| West South Central | 121 | 0.2 | 0.2% | 2.9 | 2.4% | 130 | 0.1 | 0.1% | 1.7 | 1.3% |
| West North Central | 197 | 0.7 | 0.4% | 15.8 | 8.0% | 189 | 0.2 | 0.1% | 4.6 | 2.4% |
| Mountain | 75 | 0.1 | 0.1% | 3.4 | 4.5% | 57 | 0.1 | 0.2% | 0.8 | 1.4% |
| Pacific | 96 | -[5] | -[6] | 2.7 | 2.8% | 91 | -[5] | -[6] | 1.0 | 1.1% |
| Total[7] | 1282 | 1.6 | 0.1% | 30.8 | 2.4% | 1282 | 1.0 | 0.1% | 11.4 | 0.9% |

[1]Federal Railroad Administration, 1972-1974 Waybill Files.
[2]Estimated from Federal Railroad Administration Waybill Files.
[3]From computer analysis.
[4]For all carriers operating in the Northeast. Approximately 30 percent of regional volume is for ConRail carriers.
[5]Less than 50,000 tons.
[6]Less than 0.05 percent.
[7]Detail may not add to total due to rounding.

Table 3. Shipments originating or terminating on lines with petitions pending and apparently uneconomic lines, by commodity

| STCC[1] | Commodity Description | National total rail shipments[2] (millions of tons) | Originations (millions of tons) | | | | Terminations (millions of tons) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | On PP Lines[3] | | On AU Lines[4] | | On PP Lines[3] | | On AU Lines[4] | |
| | | | Total | Percent of national total | Total | Percent of national total | Total | Percent of national total | Total | Percent of national total |
| 01 | Farm products | 119 | 0.8 | 0.7% | 16.8 | 14.1% | –[5] | –[6] | 1.2 | 1.0% |
| 11 | Coal | 291 | –[5] | –[6] | 1.8 | 0.6% | –[5] | –[6] | 0.4 | 0.1% |
| 14 | Non-metallic minerals | 147 | –[5] | –[6] | 1.7 | 1.2% | –[5] | –[6] | 1.2 | 0.8% |
| 20 | Food products | 90 | 0.1 | 0.1% | 2.2 | 2.4% | 0.2 | 0.2% | 1.4 | 1.6% |
| 24 | Lumber and wood products | 92 | 0.4 | 0.4% | 4.7 | 5.1% | 0.1 | 0.1% | 1.0 | 1.1% |
| 26 | Pulp and paper products | 42 | –[5] | –[6] | 0.4 | 1.0% | –[5] | –[6] | 0.5 | 1.2% |
| 28 | Chemicals | 83 | –[5] | –[6] | 0.5 | 0.6% | 0.3 | 0.4% | 2.5 | 3.0% |
| 29 | Petroleum and coal products | 43 | –[5] | –[6] | 0.4 | 0.9% | 0.1 | 0.2% | 0.6 | 1.4% |
| 32 | Clay and concrete products, etc. | 65 | 0.2 | 0.3% | 1.2 | 1.8% | –[5] | –[6] | 0.9 | 1.4% |
| 33 | Primary metals | 60 | –[5] | –[6] | 0.3 | 0.5% | –[5] | –[6] | 0.7 | 1.2% |
| 34-37 | Metal products, machinery, etc. | 41 | –[5] | –[6] | 0.2 | 0.5% | –[5] | –[6] | 0.4 | 1.0% |
| 40 | Waste and scrap | 39 | –[5] | –[6] | 0.5 | 1.3% | –[5] | –[6] | 0.2 | 0.5% |
| | All others | 170 | 0.1 | 0.1% | 0.3 | 0.2% | –[5] | –[6] | 0.4 | 0.2% |
| | Total[7] | 1282 | 1.6 | 0.1% | 30.8 | 2.4% | 1.0 | 0.1% | 11.4 | 0.9% |

[1]Standard Transportation Commodity code.
[2]Federal Railroad Administration, 1972-1974 Waybill Files.
[3]Estimated from Federal Railroad Administration Waybill Files.
[4]From computer analysis.
[5]Less than 50,000 tons.
[6]Less than 0.1 percent.
[7]Detail may not add to totals due to rounding.

In Tables 4 and 5 greater detail is provided on the use of lines with petitions pending and apparently uneconomic lines for shipping and receiving agriculturally related products. Shipments on these lines are compared to national rail shipments (as in Table 3) and, where appropriate data exists, to national production and consumption as well.

As can be seen in Table 4, grain and soybeans are likely to be the commodities most affected by any increase in rail abandonment. Nearly half of all farm-product shipments made on lines with petitions is corn, although these shipments represent only about 0.2 percent of national production. Corn also accounts for a significant portion of the shipments made on apparently uneconomic lines. However, wheat accounts for even more, with about 17 percent of the nation's wheat crop being shipped on these lines. Receipt of farm supplies will also be affected by loss of rail service (see Table 5), but to a lesser extent, particularly in terms of total volume affected.

## CONCLUSION

The preceding section presented a substantial amount of data on the mileage and traffic that could be affected by potential branchline abandonments.

Table 4. Shipments of agriculturally and silviculturally related commodities originating on lines with petitions pending and apparently uneconomic lines

| STCC[1] | Commodity Description | National production[2] (millions of tons) | Rail shipments[3] (millions of tons) | On PP lines[4] | | | On AU lines[5] | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total (millions of tons) | Percent of rail shipments | Percent of national production | Total (millions of tons) | Percent of rail shipments | Percent of national total |
| 01131 | Barley | 9.2 | 4.9 | 0.02 | 0.4% | 0.2% | 1.1 | 22% | 12% |
| 01132 | Corn | 148.2 | 31.6 | 0.35 | 1.1% | 0.2% | 3.4 | 11% | 2% |
| 01136 | Sorghum grains | 22.1 | 6.8 | 0.02 | 0.3% | 0.1% | 0.9 | 13% | 4% |
| 01137 | Wheat | 50.5 | 44.5 | 0.16 | 0.4% | 0.3% | 8.8 | 20% | 17% |
| | Oats, rye and other grains . | 20.9 | 3.8 | 0.04 | 1.1% | 0.2% | 0.7 | 18% | 3% |
| 01144 | Soybeans | 40.5 | 9.4 | 0.15 | 1.6% | 0.4% | 1.0 | 11% | 2% |
| | Other field crops | – | 16.9 | 0.03 | 0.2% | – | 0.6 | 4% | – |
| | Other farm products | – | 4.8 | 0.01 | 0.2% | – | 0.3 | 6% | – |
| 20 | Food products | – | 90.1 | 0.11 | 0.1% | – | 2.2 | 2% | – |
| 241 | Primary forest products | – | 62.4 | 0.33 | 0.5% | – | 3.3 | 5% | – |
| 242-249 | Lumber and wood products | – | 29.4 | 0.05 | 0.2% | – | 1.4 | 5% | – |

[1]Standard Transportation Commodity Code.
[2]U.S. Department of Agriculture, *Agricultural Statistics: 1975*. Washington, D.C., 1975. Figures are 1972-1974 averages.
[3]Federal Railroad Administration, 1972-1974 Waybill Files.
[4]Estimated from Federal Railroad Administration Waybill Files.
[5]From computer analysis.

Table 5. Receipts of agriculturally related commodities terminating on lines with petitions pending and apparently uneconomic lines

| STCC | Commodity Description | National total rail shipments[2] (millions of tons) | On PP lines[3] | | On AU lines[4] | |
|---|---|---|---|---|---|---|
| | | | Total (millions of tons) | Percent of national total | Total (millions of tons) | Percent of national total |
| 2042 | Prepared feed | 12.0 | 0.04 | 0.3% | 0.35 | 3% |
| 0113 | Grain | 91.6 | 0.01[5] | -[6] | 0.84[5] | 1% |
| 0114 | Oil kernels, nuts and seeds | 10.2 | 0 | 0% | 0.16[5] | 2% |
| 28991 | Salt | 3.0 | 0.005 | 0.2% | 0.10 | 3% |
| 287<br>28198<br>urea | Agricultural chemicals | 24.4 | 0.20 | 0.8% | 1.56 | 6% |
| 352 | Farm machinery | 0.9 | 0.006 | 0.7% | 0.07 | 8% |
| 242-249 | Lumber and wood products | 29.4 | 0.12 | 0.4% | 0.75 | 3% |

[1]Standard Transportation Commodity Codes.
[2]Federal Railroad Administration 1972-1974 Waybill Files.
[3]Estimated from Federal Railroad Administration Waybill Files.
[4]From computer analysis.
[5]A significant percentage of these commodities terminating on these lines are to be made into feed for local agricultural use.
[6]Less than 0.05%.

CONSAD is presently using this data to develop estimates of several of the effects such abandonments would have. The results of this study will be available early next year.

These results will be based on our analysis of the likely responses of individual rail users, but the actual estimates, like those in this paper, will be presented on a regional and national basis.

At this time we can offer some tentative conclusions based on the portion of this study which has already been completed and on the experience of ourselves and others in previous rail-planning studies.

For many rail users, there is a very substantial ability to adapt to a loss of rail service with only relatively mild effects on their operations. For others, however, the effects will be more significant. On a national basis, the adverse effects of abandonment are therefore likely to be much milder than might be inferred from our estimates of potentially affected traffic. At the local level, however, the effects can be quite significant.

There is clearly a need to explore the problems posed by branchline abandonment in greater depth at the state, substate and local levels. Funds for such rail-planning studies are provided to the states by Section 803 of the 4R Act. The present CONSAD study, with its national emphasis, can be only a start in this direction.

## FOOTNOTES

[1]I wish to thank Donald Matzzie, Chandler Lewis and Barry Hillegas for several helpful discussions during the development of this analysis and Michael Shefler for the necessary programming.
[2]I.e., those railroads which were not predecessors to ConRail. (The "ConRail carriers" were the Ann Arbor, Central Railroad of New Jersey, Erie Lackawanna, Lehigh and Hudson, Lehigh Valley, Penn Central, Pennsylvania-Reading Seashore Lines, and Reading railroads.)
[3]The year for which this density data was compiled by FRA varies from railroad to railroad.
[4]Of 344 lines tested, the 70 carload criterion would result in the following: 166 classified correctly as viable, 143 correctly as nonviable, 18 classified incorrectly as viable, and 17 incorrectly as nonviable.
[5]The Northeast Region was defined in accordance with the definition used in Section 102 of the Regional Rail Reorganization Act of 1973. The rest of the country was divided into six regions which correspond to the Bureau of the Census regions, except for some minor redefinitions of the West North Central and South Atlantic Regions required to preserve the desired definition of the Northeast Region.

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# Alternative Transport Cost: The Key Benefit Measure for Rural Rail Preservation Projects

Marc A. Johnson
Assistant Professor of Agricultural Economics
Oklahoma State University

Every state has been tantalized with promises of federal matching funds to compose a state railroad plan. The Regional Rail Reorganization Act of 1973 (P. L. 93-236) required that Northeastern states produce railroad plans before participating in the rail service continuation subsidy program (Section 402) or the acquisition and modernization loan program (Section 403). The Railroad Revitalization and Regulatory Reform Act of 1976 (P. L. 94-210) provides a similar rail service assistance program to remaining states which have established state rail plans (Section 803).

Eventually state railroad planning will become comprehensive in scope and coordinated with other modal transportation planning activities. However, the first round of state railroad plans submitted to the U. S. Department of Transportation and the type of first round plans encouraged from other states have focused upon evaluation of lines potentially eligible for rail service assistance.

The central purpose of this presentation is to rekindle an interest in using benefit-cost measures, based upon sound economic principles, to evaluate and compare rail preservation projects. This purpose will be pursued by establishing alternative transport cost as the pivotal benefit measure for rail preservation project analysis, from which various other benefit measures can be derived.

## THE PUBLIC INVESTMENT CRITERION

Since rail preservation projects are sponsored by state and federal agencies, these investment ventures must be evaluated with the broadest scope allowed by public policy analysis. Assuming an objective to maximize net social benefits from invested resources, decision-makers will seek to adjust railroad facility capacity to maximize net benefits

$$(1)\quad NB = (TR - TC) + (TEB - TEC)$$

subject to

$$(2)\quad NB \geq 0.$$

Total revenue, TR, is equivalent to the present value of operating revenues accruing to the owning railroad which are attributable to expected traffic originating and terminating on the project line. Total cost, TC, is equivalent to the present value of operating costs of serving expected traffic plus costs of railroad facility ownership which could be avoided by closing the line. These ownership costs include net material salvage value, property taxes, the portion of maintenance expenses unrelated to traffic volume and rehabilitation expenses required to continue operations [4, p. 18]. The difference, TR – TC, represents the total net financial value to the railroad of continuing operations on the line.

Both the 1973 and the 1976 Acts specify that the magnitude of rail continuation subsidies is to cover the difference between revenues and avoidable costs attributable to the project line, allowing for a reasonable rate of return on the line's value.[1] Consequently, when the net financial value to the railroad of continued operations is positive, no subsidy is authorized. When the net value to the railroad of continued operations is negative, the law authorizes consideration of a subsidy, S, equal in magnitude to the size of anticipated deficit, i.e., S = TC – TR.

The present value of total external benefits less total external costs, TEB – TEC, represents project-related net gains to participants in the economy other than the operating railroad. A portion of these values can be measured in monetary terms; another portion of these values are measured in non-monetary terms and implicitly converted to monetary equivalents in the decision calculus of each decision-maker. Gross measures of external benefits are useful to determine distribution of project benefits for identification of potential contributors to rail preservation subsidies.

Caution must be exercised to distinguish net economic gains from value transfers between economic actors, resulting from rail preservation.

Satisfaction of the nonnegative net benefit condition (2) requires that net external benefits equal or exceed the subsidy payment, i.e., TEB – TEC ≥ S. Preliminary estimates of required subsidies can be obtained by roughly measuring elements of revenues and avoidable costs to the railroad of continuing operations. Precise payments will be determined in contract negotiations between sponsoring agencies and railroads. Net external benefit estimates are not negotiable. Thorough measurement of net external benefits to rail preservation projects can proceed immediately. The purpose of this presentation is to consider an approach to measuring net external benefits, TEB – TEC.

## BENEFIT MEASUREMENT IN PRACTICE

States with railroad plans are to be commended for completing a difficult task without appropriate guidelines. Great amounts of labor and imagination are reflected in these railroad planning documents. However, three conceptual problems are common to most of these rail plans. A notable exception is Baumel's evaluation of 71 branch lines in Iowa (1).

First, there is disregard for the ability of capital and labor to move when rail service is discontinued. Land and facilities of the railroad and of closing industrial firms are assumed to vanish, never to be used in productive activity again and never to be accessible to county tax assessors (2, pp. 50-51; 9, pp. IV-17-18; 7, pp. 59-60; 11, pp. 42-46). The assumed destruction of land and capital leads to the conclusion that jobs initially lost in firms reducing output or closing are jobs lost forever to the state (2, pp. 49-50; 3, pp. 65-68; 8, p. 11; 9, pp. IV-16-17; 10, pp. IV-28-43; 7, pp. 57-59). There is also an implicit assumption that either displaced laborers are so specifically trained or that mobility costs are so high that these workers cannot find gainful employment anywhere in the state.

Secondly, state railroad planners have not carefully distinguished net benefits from gross effects of rail preservation projects. In some instances this has led to double counting of benefits. The New York plan provides an example. One benefit to rail preservation is avoidance of area income losses, measured as total annual sales of firms likely to close if the railroad closes. Another benefit is continuation of the stream of property taxes paid by these firms which would close if the railroad closes (9, pp. IV-17-18). Since taxes are paid from gross revenues of firms, property taxes have been counted twice.

In other instances values associated with effects of rail preservation are not clearly defined. For example, several states consider as a benefit, avoidance of area income losses, measured partly as wages and salaries paid by firms likely to close if the railroad closes. A separate benefit is avoidance of job losses, measured as number of jobs associated with firms likely to close if the railroad closes (2, pp. 48-52; 9, pp. IV-16-18; 7, pp. 56-59). An argument can be made for separability of values associated with area income effects and job loss effects. However, the distinction is not made clear in rail plans.

Finally, use of scaling and ranking techniques to normalize lists of noncomparable benefit measures into additive indexes has destroyed the clarity and usefulness of analytical results. Scaling clouds the perspective of absolute and relative magnitudes of effects caused by rail preservation. Scaling also permits perverse weightings implicitly to be assigned to various impact measures. Several states have used these techniques (3, pp. 83-88; 8, pp. 7-14; 9, pp. IV-21-25; 11, pp. 36-80).

An example is taken from the Minnesota rail planning document. In evaluation of one line abandonment, the Minnesota plan values a $170,000 salvage value to a railroad twice as highly as a $500,000 loss to shippers from increased freight costs, before normative value weightings are applied (8, p. 12). These effects are both in common denominator units of dollars and compensating transfers are possible. Scaling of benefit measures has perversely valued effects of line closure and obscured the possibility of compensating transfers as a means to save the line.

## ALTERNATIVE TRANSPORT COST

An approach to net external benefit measurement for rail preservation projects is needed which is more conceptually sound and more clear in exposition. The purpose of benefit measurement is to estimate the magnitude of net benefits made available with a project which would be unavailable without the project, in terms useful to decision-makers. In terms of the public investment criterion, the purpose of benefit measurement is to estimate net external benefits, TEB – TEC, for comparison with the project subsidy cost, S.

The key external benefit measure for rural rail preservation projects is alternative transport cost. This measure implies much more than a mere comparison of freight rates between two alternative transport modes. Alternative transport cost is defined as the gross reduction in local value of goods and services produced and consumed locally, resulting from alterations in transport patterns. When rail line closure would force local firms to modify their transport patterns, the reduction in local value of goods produced and consumed locally is a loss avoidable by rail preservation. Thus, alternative transport cost is a measure of net monetary external benefits to rail preservation, i.e., $TEB_m - TEC_m$. Measurement of alternative transport cost also provides a vehicle to identify the distribution of effects

upon various elements of a community and to identify net non-monetary external benefits attributable to rail preservation projects.

Factors contributing to alternative transport cost include a) changes in market prices resulting from changes in markets, b) changes in freight rates resulting from choice of different transport modes, c) changes in transshipment and terminal costs, d) changes in quantities of goods traded resulting from competitive market or production cost limitations and e) investment costs associated with modifications in the firm's loading facilities. Alternative transport cost can be defined more precisely for two types of situations, a) local shippers of commodities serving national markets and b) local receivers of commodities serving local markets.

## Local Shippers Serving National Markets

Consider a single, local firm producing commodities with outlets in markets A and B. Assume these markets are served by numerous producers establishing competitive market conditions represented by constant demand prices facing the firm, in each market (see Figure 1). The competitive firm supply function, S, depicts the producer's willingness to sell products at the plant door. Thus, supply functions in the two market diagrams of Figure 1 are symmetrical.

Suppose the least transportation cost to each market is $t_a$ and $t_b$ per unit, respectively, yielding respective site prices of $P_a$ and $P_b$. Transportation cost includes freight rate and terminal and transshipment costs. Suppose also that the initial least cost shipping patterns involve local railroad service. At the initial equilibrium this firm will produce quantity $Q_1$ in each period and sell the entire amount in market B.

Now, suppose rail service discontinuation is proposed. Direct rail shipment no longer would be an available alternative. The firm would be forced to design a new marketing and transportation pattern considering numerous available options. Products might be trucked to each market, trucked to a nearby rail siding for subsequent rail shipment, trucked to a nearby river port for subsequent barge shipment or moved by piggy-back. Variable transport costs to markets A and B would increase to $t_a' = P_a^m - P_a'$ and $t_b' = P_b^m - P_b'$ per unit, respectively.

Continued shipment to market B would cause the firm to reduce output to $Q_2$ and receive a site price of $P_b'$. However, switching the market orientation to market A would result in a new firm equilibrium at output quantity $Q_3$ and site price $P_a'$. Total benefit to the producer firm of saving the railroad is represented as the present value of the quasi-rent stream $P_b P_a' xy$ per period plus any capital expenditure which would have been required to modify plant loading facilities. This is the amount the firm would be willing to contribute to a rail preservation subsidy. The portion $P_b P_a xv$ represents net consumer gains and transportation resource savings collectible by the producer firm, due to rail preservation.[2] The portion vxy is a net economic rent gain from producing incremental output volume.

Note that measurement of alternative transport cost only as a change in freight rates and transshipment costs, assuming no change in the marketing pattern, necessarily overstates the benefits of rail preservation. Had the firm in Figure 1 continued to ship to market B after losing rail service, alternative transport cost would have been the present value of the stream $P_b P_b' zy$ per period. By recognizing that the firm would switch sales to market A reduces alternative transport cost by the present value of the stream $P_a' P_b' zx$ per period.

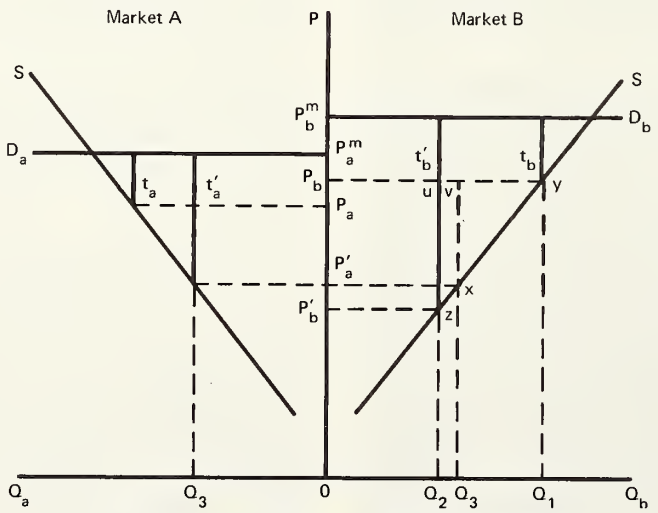


**Figure 1. Local shippers serving national markets.**

### Local Receivers Serving Local Markets

Consider a single, local firm receiving commodities for local distribution. The demand function facing the firm is downward sloping, reflecting the shape of local market demand, when all local firms are affected by a change in transportation opportunities (see Figure 2). Local competitiveness forces equilibria where consumer prices paid and distributor prices received diverge only by transportation cost.

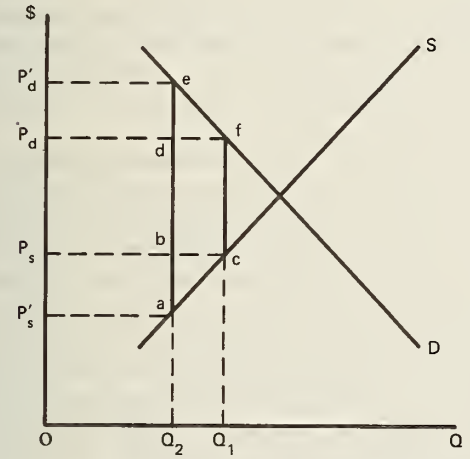


**Figure 2. Local receivers serving local markets**

Suppose the least cost transportation pattern for assembly of goods at local distribution centers involves local railroad service. Let transportation cost equal $t = P_d - P_s$ per unit. Firm equilibrium initially occurs at output quantity $Q_1$.

Now suppose rail service discontinuation is proposed. Let the next least costly assembly pattern cost $t' = P_d' - P_s'$ per unit. At the new equilibrium the firm would produce output $Q_2$. Preservation of rail service would save consumers the present value of $P_d' P_d fe$ per period. This is the amount organized consumers would be willing to contribute to a rail subsidy. Continued rail service would save producers the present values of the quasi-rent stream $P_s P_s' ac$ per period plus any capital expenditures which would be required to modify plant unloading facilities. This is the amount the firm would be willing to contribute to a rail subsidy. In the presence of competitive modal transportation markets, the present value of $P_d' P_d de$ per period represents a transportation resource savings collectible by consumers. The present value of $P_s P_s' ab$ per period represents a transportation resource savings collectible by producers. Net economic benefits also include the present value of producer's surplus (triangle abc) and consumers' surplus (triangle def) resulting from output units which would not be produced in the absence of rail service.

## USING THE ALTERNATIVE TRANSPORT COST MEASURE

Assume linear firm supply and demand functions and an indefinitely long time horizon. The annual consumers' surplus gain resulting from continued rail service to firm j, $CS_j$, is equal to the change in consumer price, $\Delta P_d$, times the original product volume, Q, less half the change in consumer price times the anticipated change in product volume if the line is closed, $\Delta Q$, i.e., $CS_j = \Delta P_d \cdot Q - 1/2\Delta P_d \cdot \Delta Q = \Delta P_d (Q - 1/2\Delta Q)$. The present value of an annual benefit of this magnitude is $CS_j \cdot r^{-1}$ where r is the discount rate employed. Similarly, annual producer's surplus gains to firm j resulting from continued rail service, $PS_j$, is equal to the change in site price, $\Delta P_s$, times the original product volume, less half the change in site price times the anticipated change in product volume if the line is closed, i.e., $PS_j = \Delta P_s \cdot Q - 1/2\Delta P_s \cdot \Delta Q = \Delta P_s (Q - 1/2\Delta Q)$. The present value of this benefit stream is $PS_j \cdot r^{-1}$.

Thus, net monetary external benefits from saving railroad service to a station is estimated as the sum across rail using firms of present values of consumers' and producers' surplus gains from rail preservation, i.e.,

$$(3) \quad TEB_m - TEC_m = \sum_j [CS_j + PS_j] r^{-1}$$
$$= \sum_j [(\Delta P_d + \Delta P_s)(Q - \tfrac{1}{2}\Delta Q)]_j r^{-1}$$

This net monetary benefit measure for retaining service to a particular station is a key data element in complete line preservation project analysis (5).

Where the demand price is unaffected by availability of local rail service, as in the case of local shippers serving national markets, net monetary external benefits of line preservation are wholly accounted for in the present value of producer rent savings, i.e., $\Sigma_j [\Delta P_s (Q - 1/2\Delta Q)]_j r^{-1}$. In cases of local receivers serving local markets, net monetary external benefits of rail preservation are the sum of consumers' and producer's net gains, i.e., $\Sigma_j [\Delta t (Q - 1/2\Delta Q)]_j r^{-1}$ since $\Delta P_d + \Delta P_s = \Delta t$ and $\Delta t$ is defined as the change in transportation cost per unit. When government decision-makers are evaluating rail preservation projects on grounds of market efficiency alone, government could pay no more than $TEB_m - TEC_m$ defined in (3) to preserve rail service.

Variables to quantify include only the original rail traffic volume, Q, the anticipated change in traffic volume if the line was closed, $\Delta Q$, and either the change in transportation cost, $\Delta t$, or the change in site price, $\Delta P_s$, depending upon whether loss of rail service affects demand prices. Original traffic volume can be obtained from shipper surveys or from direct access to railroad shipment records. The benefit measure derived in equation (3) assumes stationary traffic flow. Traffic growth, indicated in ship-

per surveys or in economic base studies, can be incorporated in one of two ways. Stationary traffic growth paths can be included by multiplying benefit measures by a compounding factor $(1 + g)^t$ where g is the constant traffic growth rate and t is the time period. One time traffic growth associated with an expected plant expansion can be added to traffic volume in periods after the date of output expansion.

Change in output volume anticipated with line closure cannot be estimated accurately without knowledge of firm supply and demand elasticities. These are complex measures of output response to changes in input and output prices, which are unknown for most industries (6). Subjective estimates of output reduction with line closure can be gained from shipper surveys. Changes in site price (transportation cost) are estimated by evaluating all market and transportation alternatives which exclude local rail service and selecting the pattern yielding the highest site price (lowest transportation cost).

## OTHER TYPES OF BENEFITS

Objectives of decision-makers need not be limited to market efficiency. However, each nonefficiency goal is attained with an opportunity cost of lost efficiency. Economic tools can be used to measure efficiency costs of diverging from economically efficient actions to achieve other goals.

One benefit of rail preservation mentioned in nearly all state rail plans is number of rail-related jobs saved. The number of jobs expected to be lost locally with rail line closure is estimated by shippers at the same time anticipated output reductions are estimated. The value placed on a job must be limited to the social value related to maintaining low unemployment and enhancing human dignity. The value of jobs in terms of wages are already considered in market analysis. The efficiency cost per job retained locally in a rail preservation project can be estimated as the required subsidy payment less net monetary external benefits (i.e., the social deficit) divided by the number of jobs which will be saved, J, i.e., $(S - TEB_m + TEC_m)/J$. The number of jobs involved and the efficiency cost per job are reported in the net nonmonetary external benefit account.

A useful nonmonetary indicator of stress put upon energy resources due to transportation facility changes is the resulting change in gallons of fuel consumed. From the best alternative marketing and transportation pattern discovered when calculating alternative transport cost, ton-miles of commodity movements carried by each mode are readily determined. The ton-mile measurement must include the entire haul from origin to destination. Ton-miles of commodity movements originally carried by each mode can be calculated from traffic information required for estimation of alternative transport cost. Gallons of fuel consumed is estimated by dividing these ton-miles of transportation service performed by each mode, by the respective transportation-energy efficiency ratio. The ratio is typically reported in units of ton-miles of output per gallon of fuel input. The difference in gallons of fuel consumed without the railroad less gallons consumed with the railroad is a measure of fuel which can be saved by continuing rail service. The measure is not necessarily positive.

The efficiency cost of saving a gallon of fuel is the social deficit of the rail preservation project divided by gallons of fuel saved, F, i.e., $(S - TEB_m + TEC_m)/F$. The value placed on this measure must reflect only the demand for energy preservation over time. Value of fuel in current use is already considered in transportation costs. Total gallons of fuel saved and efficiency cost per gallon are reported in the nonmonetary account.

Pollution prevention is measured similarly. Formulas have been produced to convert traffic moved by each mode to pounds of pollutants. Pounds of pollutants are summed across modes for marketing and transportation patterns with and without rail service. Pounds of pollutants generated without the railroad less pollutants generated with the railroad is the amount of pollutants avoided by preserving the railroad. The social deficit of the project divided by pounds of pollutants saved, P, equals the efficiency cost per pound of pollutants avoided, i.e., $(S - TEB + TEC)/P$. Total pounds of pollutants and efficiency cost per pound are reported in the nonmonetary account.

The effect of line closure on the local property tax base has been measured in several states. Wisconsin measured total property taxes paid by firms likely to close as net property tax losses (11, p. 42). New York added to this measure all property taxes paid by the railroad firm on the line under investigation (9, IV-17-18). Three points are important. First, Section 306 of the Revitalization Act prohibits railroad *ad valorem* assessment and tax rates at levels higher than those applied to other commercial and industrial property in the taxing jurisdiction. Secondly, railroad land and properties of closing firms will continue to be owned by someone and thereby will continue to generate property tax revenues with or without the presence of the railroad. The only reduction in tax base will result from reclassification of abandoned rights of way to agricultural and forestry use. The third point is the most important. Property tax is not a real value. Property taxes are portions of the value of property. The value of property depends on rents returned in production. Thus, property tax reductions with line closure are already counted in rent reductions accompanying declining output.

## CONCLUSIONS

A summary of benefit and cost measures for rail preservation projects is provided in Table 1. Net

Table 1. Benefit and cost measures for rail preservation projects

| Account | Measure | Units |
|---|---|---|
| Net monetary external benefits | $TEB_m - TEC_m$ | Dollars |
| Required subsidy | $S$ | Dollars |
| Benefit/Cost | $(TEB_m - TEC_m)/S$ | None |
| Social deficit | $S - TEB_m + TEC_m$ | Dollars |
| Jobs | $J$ | Number |
| | $(S - TEB_m + TEC_m)/J$ | Dollars/Job |
| Fuel | $F$ | Gallons |
| | $(S - TEB_m + TEC_m)/F$ | Dollars/Gallon |
| Pollution | $P$ | Pounds |
| | $(S - TEB_m + TEC_m)/P$ | Dollars/Pound |

monetary external benefits are equal to alternative transport cost savings attributable to a project, measured in dollars. Comparison of alternative transport cost savings with the present value of the required subsidy yields a monetary benefit-cost ratio for the project. Where this ratio is less than unity, consideration of nonmonetary goals becomes critical. The difference between the subsidy measure and the alternative transport cost measure provides an estimate of the monetary social deficit for the project. In the spirit of output oriented public budgeting, measures are developed to show the opportunity cost of nonmonetary goal achievement. These measures can be compared with those of other types of state programs to determine whether rail preservation projects are an efficient method of achieving other social goals.

Display of numerous benefit measures without a single common denominator should not be considered unattractive. Project analysts take themselves too seriously. They seek to collapse all relevant information into a single index for ranking. This often obscures project effects and destroys comparability of net benefit measurements across government service activities. Implicitly the single index approach also undermines the role of decision-makers in selecting projects.

Estimation of alternative transport cost requires deep understanding of market and transportation alternatives of shipping and receiving firms. Considerable opportunity exists to study marketing and transportation characteristics in numerous industries, at the firm level. However, a first step to improve project evaluation is to encourage adoption of conceptually sound analytical tools which objectively measure net benefits.

## FOOTNOTES

[1]Regional Rail Reorganization Act (P.L. 93-236) Section 304 Subsection (C)(2); Railroad Revitalization and Regulatory Reform Act (P.L. 94-210) Section 802 Subsection (6)(a)(ii)(A).

[2]The portion $P_bP_a'xv$ is more clearly represented in its components. Consider what the change in site price on volume $Q_3$ means:

$$P_b - P_a' = (P_b^m - t_b) - (P_a^m - t_a') = (P_b^m - P_a^m) + (t_a' - t_b).$$

Rail preservation would cause product to be moved where consumers value the product more highly. The net consumer gain component is $(P_b^m - P_a^m) \cdot Q_3$. If transportation markets are competitive the magnitude $(t_a' - t_b) \cdot Q_3$ represents the value of transportation resources released to other service with rail preservation. Thus, the portion $P_bP_a'xv$ represents a net gain.

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# Toward Optimizing the Rail Transportation and Distribution System

C. Phillip Baumel, John J. Miller and Thomas P. Drinka
Professor of Economics and Research Associates in Transportation Economics, respectively, Iowa State University

The public debate on how to improve and modernize the rail transportation system continues to make front page headlines. The fundamental issue underlying the debate is how rail shippers, rail receivers and railroad companies can each minimize their own costs. Rail shippers and receivers traditionally have had little or no investment in rail lines. Therefore, they minimize their transportation costs by having access to a high quality, well maintained rail line and a supply of rail cars available when they desire to ship or receive products. From their point of view the railroad investment costs in rail lines, rail cars and locomotive power are external costs. However, car shortages, infrequent service or abandonment of their rail line can result in increased shipper or receiver internal transportation costs.

Railroads, on the other hand, attempt to minimize their internal costs by minimizing their investment in rail equipment and track and by maximizing equipment utilization through coordination of shipping schedules and through increased shipment sizes. The costs generated by moving products to or from a reduced amount of track, or the costs of shipping and receiving large quantities of products are borne by the shippers and receivers and are, therefore, external to the railroads.

Transportation and distribution costs to the public are minimized when the combined net shipper, receiver and carrier costs are minimized. Research on improving the railroad system is therefore incomplete unless it includes both transportation and distribution costs. In addition, the research should clearly specify whose revenue is maximized or whose costs are minimized.

The purpose of this paper is to present estimates of the benefits to shippers from upgrading and maintaining branch rail lines and the costs to railroad companies or the public of upgrading and maintaining the rail lines. This paper relies heavily on the results of a recently completed study (2), which estimated the costs and benefits of upgrading and maintaining 71 branch lines in Iowa.[1]

The benefits from upgrading were defined as the total annual transportation and handling cost saving to grain shippers, fertilizer receivers, and shippers and receivers of other products, if the line is upgraded rather than abandoned. The costs of upgrading—the external costs to rail shippers and receivers—were defined as the total annualized cost of upgrading the line to 263,000-pound carrying capacity and to Federal Railroad Administration Class II standards—maximum speed of 25 miles per hour—plus the fixed cost of maintaining the line at that level of upgrading. With the declining number of 40-foot, narrow-door boxcars and the increasing use of 100-ton hopper cars, light branch lines with carrying capacities of less than 263,000 pounds are no longer functional for today's rail transportation. Therefore, keeping the light rail lines in their present condition was not considered as an alternative.

In order to determine the impact of rail upgrading or abandonment, a number of assumptions were required. The analysis and results of this study are based on and subject to the following assumptions.

1. That 100-ton jumbo covered hopper cars will be the major type of rail car for grain and fertilizer transportation in the future. The number of boxcars in service has declined dramatically in past years, and if the present trend continues as it has since 1968, the supply of 40-foot narrow-door boxcars will be exhausted by 1984. Farm-

ers and shippers will continue to use modes of transportation and sell grain to markets that yield them the highest net returns.
2. Gasoline and diesel fuel prices will increase more rapidly than other transportation and handling costs.
3. Grain production and grain exports will continue to increase in the future.
4. Fertilizer usage will continue to increase. All corn and soybean processors in Iowa will require enough corn or soybeans to equal at least 90 percent of their projected 1980 annual processing capacity.
5. All rail lines not included in this study will remain in service.

## METHOD OF ANALYSIS

The two major products handled on the 71 branch lines in the study are grain and fertilizer. In addition, a variety of other products move on these lines. In general, the volume of other products is relatively small unless a manufacturing plant or mine was located on the line. Separate models to estimate the benefits of upgrading were developed for grain, fertilizer and other products.

The nature and scope of the grain distribution system in Iowa where economies of large grain shipments exist suggest a method of analysis based on a transshipment plant-location model; this type of model is used to determine the optimal structure of an industry when transportation costs are incurred from origin to plant and from plant to destination. Stollsteimer developed such a model to determine the optimal number, size, and location of plants when either transport costs from origins to plants or transport costs from plants to destinations were relevant (9). Extensions of this model, incorporating both the transport cost from origins to plants and plants to destinations were later developed (1 and 7). The present analysis uses a variation of these extensions (2).

In the present analysis, the objective function of the grain model is to maximize net revenue to producers under various rail line networks. Net revenue is defined as the income received at final destination minus all handling costs (other than previously sunk costs), minus all transportation costs from farm to destination. The optimal number of subterminals, the optimal locational pattern of subterminals, and the optimal flow of grain from origins to final destinations, given the rail line network, is determined.

The benefits to fertilizer receivers under alternative rail line networks are estimated in essentially the same manner as for grain shippers. A modified Stollsteimer transshipment model is used to minimize the cost of transporting the projected 1980 dry fertilizer requirements of retail fertilizer dealers from the supply points to the existing retail locations under various rail line networks. Given the rail line network, the model determines the optimal number and location of fixed conveyor facilities and the optimal flows of dry fertilizer from supply points to retailers (9).

The other products model determines the optimal flow of each commodity other than grain and fertilizer by minimizing the cost of transporting the projected 1980 quantity of each commodity from locations with rail service to receivers on abandoned lines and from shippers on abandoned lines to locations with rail service under alternative rail line networks.

The intensive study lines are analyzed one by one in the order defined by a ratio, defined as follows: the number of cars originating or terminating at all stations of the intensive study line from January 1, 1972 to August 31, 1974 divided by the annual upgrading and fixed maintenance cost of the line. The number of cars originating or terminating on the line and the commodity carried was obtained from the records of all railroads operating in the state. During the period of analysis of car volume, cars were in short supply during half the period but were in surplus during the remainder of the period.

Product flows are first optimized on the basis of maximizing the net revenue from grain and minimizing the cost of fertilizer and other products, assuming that a given rail line is upgraded. The "best" system of transporting these products with the rail line upgraded is identified, given grain market prices and transportation and handling costs from origin to destination. The flows are then reoptimized under the assumption that the rail line is abandoned. This solution identifies the "best" system of transporting products with the rail line abandoned. The economic benefit of upgrading the rail line is defined by the difference between these two solutions. The estimated benefits of upgrading are the total annual transportation and handling cost savings to grain shippers, fertilizer receivers, and shippers and receivers of other products generated by the upgrading (rather than abandonment) of the line.

### Data

All transportation, handling and facility investment cost data used in the models were in late-1974 price levels. The quantities of grain, fertilizer (4), and other products requiring transportation were projected to 1980; the total amount of projected traffic is substantially larger than the 1972-74 levels. Iowa grain processing demand was also projected to 1980. Grain prices at final destinations less handling and transportation costs determine the quantities of grain shipped to each market; actual delivered prices for corn and soybeans at each of 19 major markets were obtained for the period of April, 1974 to March, 1975.

Rail rates were obtained for various sizes of shipments from each Iowa origin to each of the 19 major Iowa grain markets; these rates were at the Ex Parte 305-A rate levels that were in effect from June 20, 1974 to April 27, 1975. Fertilizer rail rates at the Ex Parte 305-A rate level were obtained from each major fertilizer producing area to each retail and warehouse location in Iowa. Barge rates, obtained from barge tariffs in effect from April, 1974 to March, 1975, were adjusted by the average quarterly percent of tariff paid by a medium and a large size shipper located on the Middle Upper Mississippi River.

Farm-to-elevator and farm-to-subterminal trucking costs were estimated for each type of vehicle used by farmers to haul grain. Mid-1974 prices of gasoline and diesel fuel delivered to farmers and truckers were $0.50 and $0.45 per gallon, respectively. The delivered fuel prices to farmers and truckers were increased to $0.60 and $.50 per gallon, respectively, to specify higher fuel prices for truck shipments than for rail or barge shipments. The estimated trucking costs were weighted by the proportion of grain hauled from farm to elevator by vehicle type; the weights were obtained by examining 15,180 scale tickets for grain delivered by farmers to a local cooperative during May-June, 1974 and Oct.-Nov., 1974. The weighted cost functions, used to estimate the following aggregate cost functions[2] for hauling grain from farm to elevator and subterminal with an empty return, are the following:

Harvest time: $C_b = \$0.047 + \$0.0013\ m$

Nonharvest time: $C_b = \$0.058 + \$0.0011\ m$

where

$C_b$ = cost per bushel

$m$ = loaded miles.

The constant includes the vehicle ownership costs and the cost of loading and unloading the grain. Similar trucking cost functions were estimated for trucking grain from elevator to market and for trucking fertilizer and other products into or out of locations on branch rail lines.

Published research on variable grain handling costs at elevators, subterminals and barge loading facilities were utilized (8). Handling costs for fertilizer and other products and the costs of expanding grain and fertilizer receiving, storage and load-out facilities were estimated from data collected from industry representatives.

The costs of upgrading a rail line are the following: the net cost of upgrading the line, annualized over a 35-year period; minus the estimated salvage value of the upgraded line at the end of 35 years, discounted over a 35-year period; plus the estimated annual fixed maintenance cost—43 percent of total maintenance cost—of the upgraded rail line; plus the salvage value foregone if the line is upgraded, annualized over a 35-year period.

Two methods of upgrading were used to estimate upgrading costs. For low-cost upgrading, used 90-pound rail was utilized to replace existing light rail, and interest was computed at 7 percent per annum. There is insufficient used 90-pound rail available to upgrade all branch lines in Iowa in this manner, but some of the lines could be upgraded that way. The second method of upgrading considered was to replace existing light rail with new continuous welded 115-pound rail; interest on this expenditure was computed at 10 percent per annum.

Table 1 presents the total cost of upgrading typical Iowa light branch rail lines in relatively level terrain and in relatively hilly terrain in early 1975 prices. The cost of upgrading to handle jumbo hopper cars was about $110,000 per mile in early 1975; these costs assume the availability of used 90-pound rail to replace the lighter rail found on many branch lines. The cost goes up to as much as $162,000 per mile if the line runs over rivers or through hilly country requiring bridges and structures. The annualized upgrading and fixed maintenance cost of the two rail lines in Table 1 at 7 percent annual interest are $10,130 and $16,350, respectively, per mile.

Table 1. Estimated total cost per mile of upgrading typical light rail lines with used 90-pound rail by type of terrain, January 1975 cost levels, Iowa

| Cost component | Level terrain | Hilly terrain |
|---|---|---|
| Replace 1200 ties | $ 26,250 | $ 26,400 |
| Add 2000 cubic yards of ballast | 14,000 | 14,000 |
| Replace light rail | 29,000 | 29,000 |
| Labor | 14,340 | 14,340 |
| Bridges | 0 | 65,250 |
| Other track material | 37,000 | 21,000 |
| Less salvageable material | -10,590 | -7,990 |
| Total cost per mile | $110,000 | $162,000 |

To provide a range of upgrading costs for each rail line, the annualized cost of upgrading light rail lines was computed using new 115-pound continuous welded rail and 10 percent annual interest. Under these conditions, the annualized cost per mile of upgrading the two lines in Table 1 are $16,135 and $23,780 respectively per mile per year. The two methods provided a range of upgrading costs—with actual costs probably falling somewhere within this range.

After obtaining the annual benefits to shippers and receivers of keeping a rail line in service and the annual cost of upgrading, a benefit-cost ratio was obtained for each line by dividing the total benefits from upgrading the line by the annualized upgrading and maintenance costs.

Seventy-one branch rail lines were included in the study. These lines represent 32.9 percent of the total rail line mileage in Iowa. Most of the 71 lines are lighter volume lines in relatively poor condition and may be considered as potential candidates for abandonment. If the benefit-cost ratio determined for a line is greater than 1.00, the annual benefits from upgrading and maintaining the line exceed the annual costs. If the resulting ratio is 1.00, annual costs of upgrading are equal to the benefits. If the ratio is less than 1.00, the costs of upgrading exceed the benefits.

Three sets of solutions were computed. One set was based on traditional single-car rates. A second set was based on the multiple-car structure which includes single-car, 3- to 10-car, 25-car and 50-car grain rates, and single-car fertilizer rates from each origin to each retail destination and 10-car rates to large fertilizer warehouses. The third set of solutions was based on estimated single-car, 3- to 10-car, 25-car, and 50-car rail costs for grain and fertilizer along with estimated costs for 85-car trains scheduled to run continuously between Iowa origins and Gulf of Mexico export elevators (6); referred to as the "85-car cost structure," this system was based upon estimated costs, since the rate structure is not presently available in Iowa. A set of six benefit-cost ratios was obtained for each of the 71 lines using the two different upgrading costs and under the three different rate or cost structures.

## FINDINGS

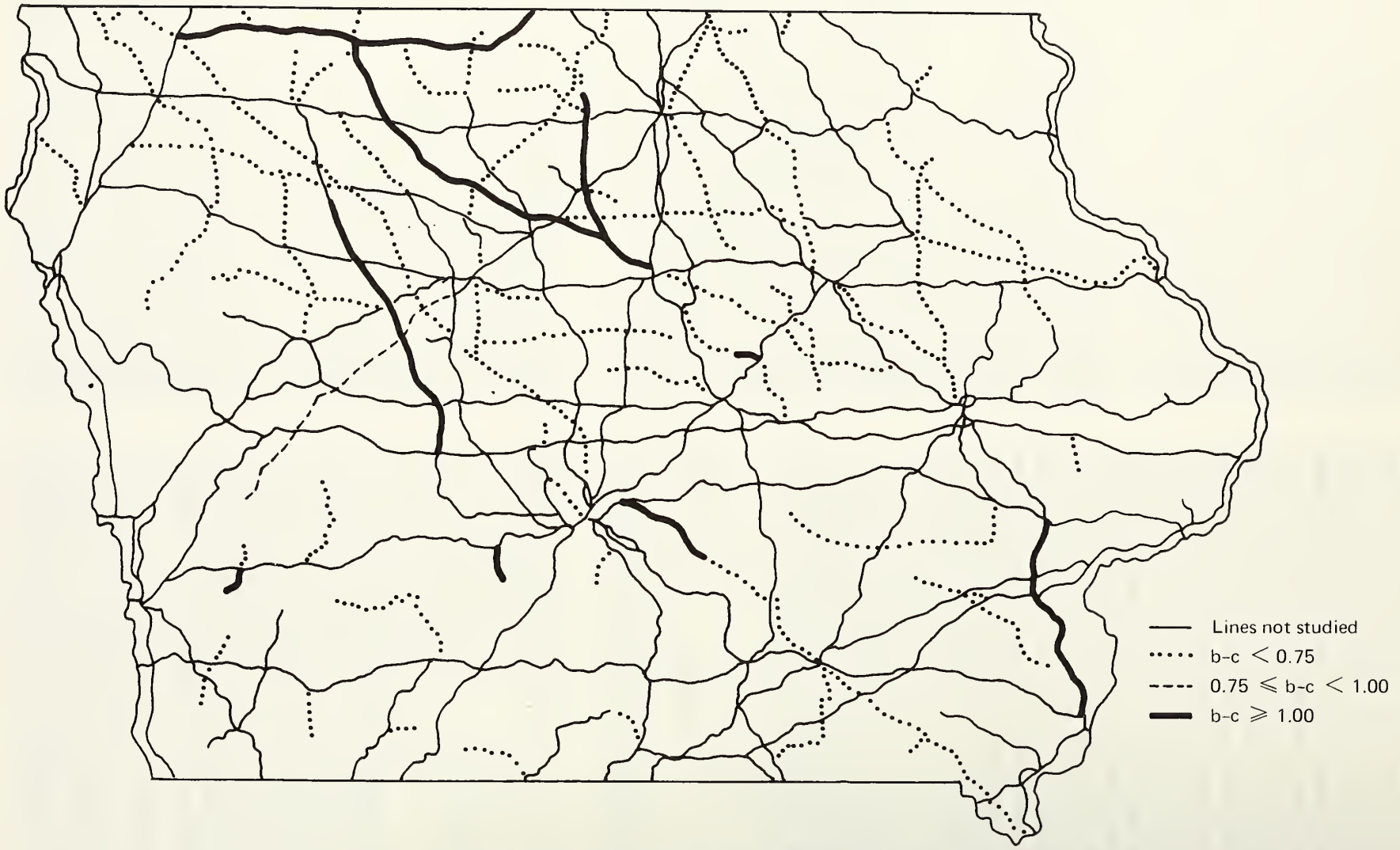
Of the 71 study rail lines evaluated, 10 produced a benefit-cost ratio greater than 1.00 under one or more of the six possible solutions; these lines, with their benefit-cost ratios, are listed in Table 2. The mileage of the non-study lines, plus the mileage of the study lines with benefit-cost ratios greater than or equal to 1.00 under the existing multiple-car rate solution with upgrading with used 90-pound rail, represents 72.1 percent of the total rail line mileage in Iowa. The lines with benefit-cost ratios less than 1.00 represent 27.9 percent of total rail line mileage in Iowa. During the period January 1, 1972 to August 31, 1974, this latter set of lines originated and/or terminated only 6.1 percent of the total number of cars in Iowa.

Of these 10 lines, only 4 achieved benefit-cost ratios $> 1.00$ from large grain transportation and handling cost savings; 5 achieved benefit-cost ratios $> 1.00$ from large industrial product transportation and handling savings. The remaining line achieved a benefit-cost ratio $> 1.00$ primarily because it is in rather good condition, requiring a small investment to upgrade it.

The type of rail rate or cost structure had only minimal impact on the number of lines found to produce benefit-cost ratios $\geq 1.00$. Under upgrading with 90-pound rail, both the single-car rate solution and the existing single- and multiple-car rate solution had 8 lines with benefit-cost ratios $\geq 1.00$; the multiple-car cost solution utilizing the 85-car continuous train had 7 lines with benefit-cost ratios $\geq 1.00$. The type of rail used in upgrading also was found to have only a minimal impact on the number of rail lines with benefit-cost ratios $\geq 1.00$. Each rate or cost solution utilizing 115-pound continuous-welded rail had one less line with a benefit-cost ratio $\geq 1.00$ than when used 90-pound rail was utilized. However, the use of new continuous-welded 115-

Table 2. Rail lines with benefit-cost ratios greater than 1.00, Iowa

| Line | Single-car rates | | Multiple-car rates | | Multiple-car costs | |
|---|---|---|---|---|---|---|
| | 90-pound rail | 115-pound rail | 90-pound rail | 115-pound rail | 90-pound rail | 115-pound rail |
| Estherville to Rake | | | 1.19 | | | |
| Dows to Forest City | 3.15 | 2.17 | 3.34 | 2.30 | 3.58 | 2.46 |
| Sibley to Iowa Falls | 1.89 | 1.43 | 2.25 | 1.71 | 2.10 | 1.59 |
| Moorland to Carroll | 1.41 | 1.12 | | | | |
| Altoona to Pella | 1.96 | 1.47 | 1.95 | 1.47 | 2.06 | 1.54 |
| Winear to Winterset | 11.09 | 6.87 | 11.09 | 6.87 | 11.10 | 6.93 |
| Beaman to Gladbrook | | | 2.67 | 1.75 | 1.32 | |
| Carroll to Harlan | 1.23 | | | | | |
| Hancock to Oakland | 9.67 | 6.45 | 9.46 | 6.31 | 9.29 | 6.21 |
| West Liberty to Burlington | 1.65 | 1.12 | 1.61 | 1.09 | 1.60 | 1.09 |




**Map 1. Location of study lines with benefit-cost ratios greater than 1.00, between 0.75 and 1.00, and less than 0.75 under the multiple-car rate solution with upgrading to 90-pound rail, Iowa.**

pound rail at 10 percent interest resulted in a substantial reduction in the level of some of the benefit-cost ratios.

The locations of the lines with benefit-cost ratios $\geq 1.00$, $0.75 \leq b-c < 1.00$ and $b-c < 0.75$ are shown in Map 1. Only one line within 150 miles of the Mississippi River had a benefit-cost ratio $\geq 1.00$; a large industrial plant relying largely on rail transportation is located on this line. It was found that access to water transportation significantly reduced the benefits of upgrading to grain shippers and fertilizer receivers.

Under the existing multiple-car rail rate structure, an analysis was made of the impact in Iowa of upgrading the eight rail lines with benefit-cost ratios $\geq$ 1.00 rather than all 71 rail lines (3). As seen in Table 3, net savings accruing to shippers if all rail lines were upgraded total almost $4.4 million per year. The savings to grain shippers would be about $1.5 million per year (approximately one-third of the total benefits); the savings to fertilizer dealers would be about $1.3 million while shippers and receivers of other products would save about $1.6 million per year. The reason for the small savings to grain shippers relative to the large volume of grain transported is that the cost of hauling grain an additional mile is relatively small. Furthermore, even if 63 rail lines were abandoned, there would still be a large number of rail lines in Iowa and since grain originates on a large number of widely dispersed farms, grain flows can be easily altered to minimize the additional travel to a rail line.

The annualized cost to the railroads or shippers or taxpayers—if rail line upgrading is assumed as a public expense—would be about $20 million for upgrading the additional 63 rail lines and for the salvage value foregone if the lines were abandoned. Thus, the average annual benefits to shippers from upgrading the 63 rail lines would be 21.7 cents for each annualized dollar invested in upgrading (3).

Table 3. Total annual net benefits to shippers from upgrading 71 rail lines rather than 8 rail lines and the annual costs of upgrading the rail lines in 1974 dollars

| Item | Optimal multiple-car rate solution with 71 rail lines upgraded with 90-pound rail | Optimal multiple-car rate solution with eight rail lines having a benefit-cost ratio $\geq 1.00$ upgraded with 90-pound rail | Net change |
|---|---|---|---|
| Benefits to shippers | | | |
| Total grain revenue net of transportation, storage, variable handling and drying costs, and additional grain facility investment costs | $4,584,439,800 | $4,582,954,800 | $ 1,485,000 |
| Fertilizer transportation and handling costs at fixed conveyor facilities | 46,562,500 | 47,819,000 | 1,268,500 |
| Other product transportation and handling costs | 0 | 1,605,449 | 1,605,449 |
| Total net benefits to shippers | | | $ 4,358,949 |
| Net annual upgrading and maintenance costs | | | |
| Annual net upgrading and fixed maintenance costs of rail lines upgraded | 18,714,956 | 1,856,987 | $16,857,969 |
| Annual salvage from rail lines abandoned | 0 | 3,227,058 | 3,227,058 |
| Total annual upgrading and maintenance costs | | | $20,085,027 |

## NET REVENUES AND COSTS UNDER ALTERNATIVE RATE AND COST SOLUTIONS

Analyses were made to determine the optimal rail system for the state. The analyses were based on the projected 1980 volumes of products utilizing the single-car rate system, the multiple-car grain rate system, and the multiple-car cost system with the 85-car continuous train. Only single-car rates existed prior to 1971 in Iowa, and the single-car rate system serves as the norm of comparison for the multiple-car systems. The multiple-car grain rate distribution system is the system in use today. The 85-car continuous train system is based on estimated costs, since this system is not yet available in Iowa (10).

Under statewide optimal flow analysis—presented in Table 4—the additional annual net benefit to the rural transportation system with eight of the 71 lines upgraded with 90-pound rail and operating under the present combination of single- and 50-car rates for shipping grain would be nearly $33 million more than under the traditional single-car rate system with all 71 rail lines upgraded with used 90-pound rail. The estimated additional benefits include the following: $15.5 million annual additional income on grain through savings on the 50-car rates; a cost of $1.86 million annually for upgrading and maintaining the eight lines—compared to $18.7 million for upgrading and maintaining all 71 lines; and, an annual salvage value credit of about $3.2 million from the 63 lines abandoned. Extra costs under the 50-car system would include an additional $1.3 million to distribute fertilizer to retail outlets and an additional $1.6 million for extra handling and trucking of other products into and out of the towns on the abandoned lines.

Under the multiple-car system that includes the 85-car continuous train for shipping grain to Gulf markets—presented in Table 5—the additional net benefit to the entire system would be over $42.0 million annually, compared to the single-car rate system. Benefits under the 85-car continuous train system include the following: an annual increase of about $24.3 million in revenue from grain, due to savings in large volume, low-cost transportation; and, a savings of over $17.2 million on upgrading seven lines rather than all 71 lines. Extra costs for the

Table 4. Estimated total annual net revenue to the State under the optimal rate solutions in 1974 dollars

| Item | Single-car rate solution with all rail lines upgraded to 90-pound rail | Multiple-car rate solution with the rail lines having a benefit-cost ratio $\geqslant$ 1.00 upgraded to 90-pound rail | Net change |
|---|---|---|---|
| Total grain revenue net of transportation, variable storage, handling, and drying costs | $4,583,802,600 | $4,601,251,600 | $17,449,000 |
| Less annual fixed cost of additional grain storage and subterminal facilities | 16,353,800 | 18,296,800 | 1,943,000 |
| Less fertilizer transportation and handling costs at fixed conveyor facilities | 46,562,500 | 47,819,000 | 1,256,500 |
| Less other product transportation and handling costs | 0 | 1,605,449 | 1,605,449 |
| Less annual net upgrading and fixed maintenance costs of rail lines upgraded | 18,714,956 | 1,856,987 | -16,857,969 |
| Plus annual salvage from rail lines abandoned | 0 | 3,227,058 | 3,227,058 |
| Total annual net revenue | $4,502,171,344 | $4,534,900,422 | $32,729,078 |

Table 5. Estimated total annual net revenue to the State under the optimal cost solutions in 1974 dollars

| Item | Single-car cost solution with all rail lines upgraded to 90-pound rail | Multiple-car cost solution with the rail lines having a benefit-cost ratio ⩾ 1.00 upgraded to 90-pound rail | Net change |
|---|---|---|---|
| Total grain revenue net of transportation, variable storage, handling, and drying costs | $4,609,772,600 | $4,637,160,600 | $27,388,000 |
| Less annual fixed cost of additional grain storage and subterminal facilities | 16,353,800 | 19,441,800 | 3,088,000 |
| Less fertilizer transportation and handling costs at fixed conveyor facilities | 38,234,000 | 39,375,000 | 1,141,000 |
| Less other product transportation and handling costs | 0 | 1,734,091 | 1,734,091 |
| Less annual net upgrading and fixed maintenance costs of rail lines upgraded | 18,714,956 | 1,449,511 | -17,265,445 |
| Plus annual salvage from rail lines abandoned | 0 | 3,359,200 | 3,359,200 |
| Total annual net revenue | $4,536,469,844 | $4,578,519,398 | $42,049,554 |

handling and trucking of fertilizer under this system would amount to over $1.1 million. Additional costs for the extra handling and trucking of other products would amount to $1.7 million.

The shift from the single-car rate grain transportation system to the 85-car cost structure would increase the amount of the surplus grain in Iowa shipped to Gulf export markets from 14 percent to 54 percent of the total surplus. At the same time the amount of Iowa grain shipped to Illinois processors would decline from 56 percent to 22 percent of the total surplus. This means that Illinois grain would need to be stored for use by Illinois processors rather than shipping it to Gulf export markets and then importing Iowa grain for processing.

## CONCLUSIONS

If the state were to shift to the transportation system suggested by the optimal rate solution, a number of changes would occur. The change to the use of larger multiple-car shipments would put more of central and western Iowa grain into the export market. It would increase rail shipments of grain and decrease truck shipments of grain from western and central Iowa elevators to market.

Grain shippers in central and western Iowa located on abandoned lines close to Iowa processors would truck grain short distances to Iowa processors, rather than ship the grain by rail to Illinois processors or export markets. Shippers in central and westen Iowa located on rail lines continuing in operation would ship to Illinois processors and to export markets by rail, rather than truck to local grain processors or to river markets as frequently happens today.

Farmers would increasingly haul grain to facilities with the capacity to load multiple-car shipments and 50-car trains. In central and western Iowa, at least, even if the branch rail lines are not abandoned, it appears that some of the state's grain flow will abandon some branch lines. Thus, predicting future grain traffic on branch lines on the basis of past flows may not be a meaningful method of analysis.

Shippers—and/or farmers—would enjoy increased income with the shift to a system with large volume shipments and fewer rail lines; they would encounter higher fertilizer costs, but this additional cost would be far more than offset by increased grain income.

Railroads—and/or taxpayers, if the public assumes partial or full responsibility for continued operation of branch line railroads—would benefit from the reduced cost of upgrading and maintaining fewer rail lines.

Branch line shippers and receivers of products other than grain and fertilizer would bear most of the cost, in the event of rail abandonment. Fertilizer dealers on the branch lines also may suffer some of the costs. But the combination of these increased costs are substantially less than the gains to farmers and to the railroads or taxpayers. This is why rail abandonment is controversial. When rail lines are abandoned, some participants gain and some lose.

Highway costs are affected by rail abandonment. It appears that licenses and fuel tax revenues may not be adequate in some areas of the state to pay for increased highway maintenance generated by additional truck travel on highways. In other areas of the state, tax revenues from increased local trucking may exceed the additional highway maintenance and construction costs. These additional highway costs are influenced by the condition of the highways in the area. When the additional highway costs were added to the benefits of upgrading and continuing the railroad operation, benefit-cost ratios changed only slightly.

The computer solutions indicate that additional load-out facilities for multiple-car shipments will be required in some areas of the state. Also needed will be new facilities for unloading bulk shipments of fertilizer.

One reason why so few Iowa rail lines produced a benefit-cost ratio of 1.00 or greater is that there are so many rail lines in the state. The additional distance to get to another rail line in Iowa is short; and, the incremental cost of moving products to or from another line is small, compared with the incremental cost of upgrading the rail lines. In addition, the 71 rail lines were generally low volume lines in relatively poor condition. It is estimated that the annual cost to upgrade and maintain all 71 intensive study lines examined is about $18.7 million.

It was found that at least one of four conditions is necessary for a branch line to produce a favorable benefit-cost ratio in the analysis used in this study: (1) the line must carry a sizeable volume of grain to produce transportation savings—and only four of the 71 lines analyzed met this condition in the study, (2) the line must have at least one sizeable or several smaller nonagricultural shippers to sustain a large volume, (3) the line must currently be in rather good condition so that upgrading costs are minimal, or (4) the line must be one of the few remaining branch lines in service within an area, thus inheriting additional volume from stations located on nearby abandoned lines.

The benefit-cost ratios developed for each of the lines in this study can be used in analyzing whether lines should be upgraded and kept in operation or abandoned. However, knowledge of local shipping patterns is needed for further interpretation and evaluation. Certain longer branch lines may have short segments which generate benefits in excess of the costs of upgrading. Some lines with low benefit-cost ratios might be considered for upgrading and maintenance, because of future potential, such as those in some of the coal resource areas of Iowa. And even lines with favorable benefit-cost ratios should be examined before upgrading is begun, in order to confirm that those facilities generating the rail volume are likely to continue in operation.

The benefit-cost ratios also can be used to determine where public funds could be most profitably used to upgrade the state's rail system. The state of Iowa is now allotting resources for branch rail improvement, and federal assistance is being discussed.

A number of major assumptions were required in this analysis. Of these major assumptions, three exert the strongest influence on the ratios. First, the order in which the rail lines were analyzed in each district had a major impact on the estimated benefits. The benefit-cost ratios estimated for those rail lines which were analyzed first tended to be low, while those lines which were analyzed later tended to have larger benefit-cost ratios. The rail lines which were analyzed later inherited traffic from the previously analyzed lines, and this inheritance increased the benefits from upgrading. If the order of analysis had been reversed, the rail lines analyzed earlier would have inherited more traffic, and the estimated benefit-cost ratio would have been larger. This reordering would also have reduced the benefit-cost ratios of the lines analyzed later. However, the authors believe that changing the order of analysis would not have made a significant change in the number of intensive study lines with benefit-cost ratios equal to or greater than 1.00, since a change in the order of analysis would merely redistribute the estimated benefits among the 71 lines. The lack of additional research funds prevented the reestimation of benefit-cost ratios based on different orders of analysis.

Secondly, the costs in the benefit-cost ratios are sensitive to the assumed level of upgrading. All rail lines were assumed to be upgraded to 25 mile-per-hour speed limits. If the upgrading levels were reduced to 10 mile-per-hour speed limits, upgrading costs would decrease, and the set of estimated benefit-cost ratios would have increased. However, lower speed limits increase train operating costs. Furthermore, the lower level of upgrading would tend to increase annual maintenance costs.

Thirdly, the benefits are sensitive to the assumption that all nonintensive study lines will remain in operation. A reduction in the number of nonintensive study lines would have an impact on the estimated benefits in the benefit-cost ratios for nearby intensive study lines.

The study shows that for much of central and western Iowa, large volume rail shipments remain the least-cost system of transportation for grain. Because of rising costs for replacement equipment, it appears that barge rates may increase more rapidly than rail costs in the future, thereby making barge transportation less competitive with rail in central and western Iowa.

Finally, this analysis is based strictly upon cost relationships among various systems of transportation for grain and other products. In transportation, as with agriculture and many other production activities, the lowest unit costs are associated with large volume.

Therefore, any policy that encourages the greatest net returns on grain or the least-cost handling for other products will by necessity encourage development of facilities capable of handling large volumes. Larger volume shipments not only reduce transportation and handling costs for grain and fertilizer, but also increase the opportunities for Iowa farmers to reach more distant domestic and export markets. Large volume, multiple-car rail shipments are essential, if central and western Iowa farmers are to become and remain competititve in world grain markets.

There has been, however, a concern about protecting the small independent business. Therefore, a conflict arises between achieving access to world markets through volume shipments and protecting smaller-scale businessmen located on branch rail lines. Upgrading many existing branch rail lines may tend to discourage the accumulation of the large grain volumes that are necessary to achieve lower transportation and handling costs; such upgrading would reduce the probability of more intensive and regular entry of central and western Iowa grain into the world markets.

Another concern has been the market power to control significant segments of the marketing system which firms obtain as they grow in size. However, as of March 1, 1975, 90 percent of all Iowa multiple-car grain loading facilities—all of those with 25-, 50-, and 100-car capacities—were owned by independent businessmen or farmer cooperatives; all five of the facilities capable of loading 100-car trains were owned by cooperatives.

This analysis was an attempt to minimize the combined transportation and distribution system costs for products moving on branch rail lines. Similar analyses are possible for main line corridors.

## FOOTNOTES

[1]A more complete description of the economic analysis of upgrading branch rail lines is in (3).

[2]An Illinois Agricultural Association report (5) indicates that "it costs between $0.0004 and $0.0010 per bushel to haul a load of grain one extra mile" from Illinois farms to country elevators.

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# Light Traffic Lines and Railway Abandonment

John F. Due
Professor of Economics
University of Illinois

It has long been evident that a substantial mileage of the railway network of the country carries only relatively light traffic. A primary manifestation has been application for abandonment; in the period from 1970 through 1975, for example, a total of 10,580 miles was approved for abandonment, and as of May 1976, there were applications outstanding for 6050 miles. Line mileage fell from 249,000 in 1929 to 200,000 in 1975, despite some construction. Part of the abandoned mileage was obviously redundant (for example, there were once three railroads to Goldfield, Nevada), while others left communities without rail service. But the actual abandonment figure was only the surface of the iceberg. Many railroads were notoriously slow to weed out branch lines, either through neglect, desire to avoid adverse shipper reaction, fear of rejection by the Interstate Commerce Commission (ICC), or the costs of the procedure. The problem was suddenly brought to popular and legislative concern by several events: the collapse of the Penn Central and the subsequent investigation into the cause and plans for restructuring, and the increased deterioration of many light traffic lines, to the point that continued operation became virtually impossible. Subsequently, the stress placed upon abandonment of light traffic lines in the Department of Transportation and United States Railway Association plans for restructuring the northeast railroads heightened interest in the question and led to a sharp dispute between DOT and USRA on the one hand and the Rail Services Planning Office of the ICC, shipper and community groups, and state agencies on the other.

As a consequence of this interest, various research activities have been undertaken, some under government sponsorship, some at universities and under state government support. It is the purpose of this paper to summarize certain aspects of this work, with stress on that undertaken at the University of Illinois, Urbana.

## THE VIABILITY OF LIGHT TRAFFIC LINES

One of the most significant aspects of the research has been the attempt to ascertain the volume of traffic necessary for a light traffic line to be (1) viable from a profit standpoint, without subsidy, and (2) economically viable.

The first systematic study of this type was undertaken by the firm of R. L. Banks and Associates for the Federal Railroad Administration (19). A sample of 100 light traffic lines (branches and independent roads) was selected, and an attempt made to establish a formula to determine viability of such lines according to density of traffic and length. Revenues appropriately attributable to the line and costs attributable to each line were ascertained, to determine profitability. The results showed the estimated figure of the volume of traffic necessary for roads in each of the regions to break even; in addition to the basic figures, upper and lower probability ranges were ascertained on a 90% basis. Typical figures for the Eastern region are shown below:

| *Length of line* | *Criterion level* | | |
|---|---|---|---|
| | *Upper* | *Breakeven* | *Lower* |
| *Miles* | *Cars originated or terminated** | | |
| 5 | 477 | 308 | 139 |
| 10 | 734 | 565 | 396 |
| 25 | 1,559 | 1,231 | 903 |
| 35 | 2,018 | 1,690 | 1,362 |

*Per year.

This served as the basis for the determination in DOT's preliminary plan of lines to be included in the restructured system, but including only traffic to and from points originating or terminating more than 75 cars a year, using the upper criterion.

For determining the lower limit of traffic below which subsidy should not be considered, based upon an estimate of relative rail and motor costs for different levels of traffic, DOT used the following figures:

| *Miles* | *Ton miles per mile per year* |
|---|---|
| 5 | 9,100 |
| 10 | 14,300 |
| 20 | 23,400 |
| 30 | 37,300 |

The USRA preliminary and final plans avoided the use of a general formula, and sought to ascertain the revenues and expenses attributable to each line.

This is of course a formidable task involving some very arbitrary assumptions. It did lead to a considerably smaller mileage to be abandoned — but still substantial—in the northeast. The detailed studies of individual lines in the evaluations by the Rail Services Planning Office of ICC—along with the protests—provide a very enlightening picture of branch line railroad operation in the U.S.

The 1976 DOT study of light traffic lines used a figure of 70 cars originating or terminating per mile to indicate potentially excess lines (21).

## THREE STUDIES OF CLASS II RAILROAD COST FUNCTIONS

To throw additional light on this question, three studies were made at Illinois of Class II railroad cost functions. While not all such roads are light traffic lines, most are. To determine long run cost functions, two samples were used (15). The first included 209 Class II railroads for the year 1968, the last year for which the ICC published data of these roads. The second was a sample of 44 Class II roads, using 1973 data from the reports filed with the ICC. The first sample included all Class II roads except those not typical of short line freight carriers; the second group was partly selected at random, partly typical Class II roads in two length groups. Distance (mileage, for 1968; average haul for 1973) and volume (net ton miles) were the independent variables. Regression analysis was employed. The results show that the two principal cost items, maintenance of way and transportation (train operating costs) are influenced substantially by volume but not by distance; only maintenance of equipment and traffic and administrative costs are affected significantly by distance. The major conclusions, illustrated on Figs. 1 and 2, are as follows (based primarily on the 1973 study):

1. There are substantial economies of scale, but these are primarily exhausted at a relatively low volume figure, compared to main lines—most by 140,000 net ton miles per mile (tm/m)—whereas studies by Harris and Keeler among others suggest 500,000 ton miles for Class I carriers (11 and 13).
2. Roads with traffic under 30,000 tm/m have costs in excess of 40¢ a ton mile, with a median of 51¢, a high of 75¢, and a low of 27¢.
3. All roads with traffic under 55,000 tm/m had costs in excess of 25 cents per ton mile with one exception; but no roads with volume over this figure (and hauls over 7 miles) had costs per TM in excess of 18 cents, and 20 to 31 had costs under 10 cents. No roads over 200,000 tm/m with one exception had costs in excess of 7¢ per ton mile (the median was 5.2), and 2 over 800,000 tm/m had costs under 2½ cents.

From the 1973 study tables were developed showing the length of haul on the main line necessary for a short line to be economically viable, as shown in Table I. With the assumption of truck costs of 4 cents per ton mile and short line costs of 13 cents per ton mile, for example, the main line haul would need to be 55 miles if the branch was only 5 miles; 275 miles if it were 50 miles. But with short line costs of 26 cents (traffic in the range from 35,000 to 50,000 tm/m), a short line of 10 miles would require a 240 mile main line haul; of 100 miles, 2400. These figures are subject to the constraint that transfer from truck to rail at the junction point may be cheaper. If this is taken into consideration with, for example, 13 cents per ton mile on the branch line and $1.50 per ton costs of transfer, transfer to truck would be more advantageous if the branch exceeds 17 miles in length. But if the branch line has traffic in excess of 800,000 ton miles per mile—about 60 cars a day—its costs are as low as truck costs under the most favorable trucking circumstances. With trucking costs of 4 cents per ton mile the line is viable at 400,000 tons, or 30 cars a day—with no main line haul at all.

Further study was made of the elasticity of the cost items of the median road. All cost items have elasticity less than 1; the highest is with track maintenance (.57), substantially above train operating cost (.20). The overall figure for operating costs is .24; for all costs, including return on salvage value, .25.

## SHORT RUN COST FUNCTIONS

A study was also made of short run cost functions of Class II railroads, to determine the ability to adjust costs to changes in traffic volume in a short period of time (4). Of necessity a small sample was used to make the task manageable. Ten roads, ones known to be typical light traffic freight-only roads, were selected for the period 1963 through 1973. It was necessary to deflate the various cost items to adjust for inflation. Regression analysis was employed to isolate the effects of distance and volume upon the costs. Actually, distance was found to have little or no effect on most of the variables. So far as volume was concerned, the elasticity of the reaction of total cost to changes in volume was very low—less than .3 for six of the ten roads. The other four had a much higher figure—.6—attributable almost entirely to maintenance of way, suggesting that as volume increases and more funds are available, maintenance of way expenditure is increased drastically. Equipment rental for a number of the roads also had a high elasticity, as would be expected. On the whole, the figures show a high degree of excess capacity and thus substantial gains from greater traffic volume—a conclusion similar to the long run results except that the LRAC curve flattens at a lower level of output, showing that these firms can

adjust factors more satisfactorily to output over time than in a short run period, as would be expected.

In other words, virtually any short line road will benefit substantially from an increase in the volume of traffic—except for a short period when sharp increases in maintenance of way expenditure is necessary. Equally the road will suffer from a decline. But over time, as indicated above, there is a greater degree of adjustment of factor inputs to volume of traffic.

## A COMPARISON OF SAMPLES OF ABANDONED AND SURVIVING ROADS

In another study, a sample of 30 Class II railroads that had been abandoned in the last three decades was selected, analysed for the influences on the abandonment decisions, and various data of this group compared with those of a sample of 28 of the lowest-volume Class II roads that had continued to operate down through 1975 (9). The abandoned-lines

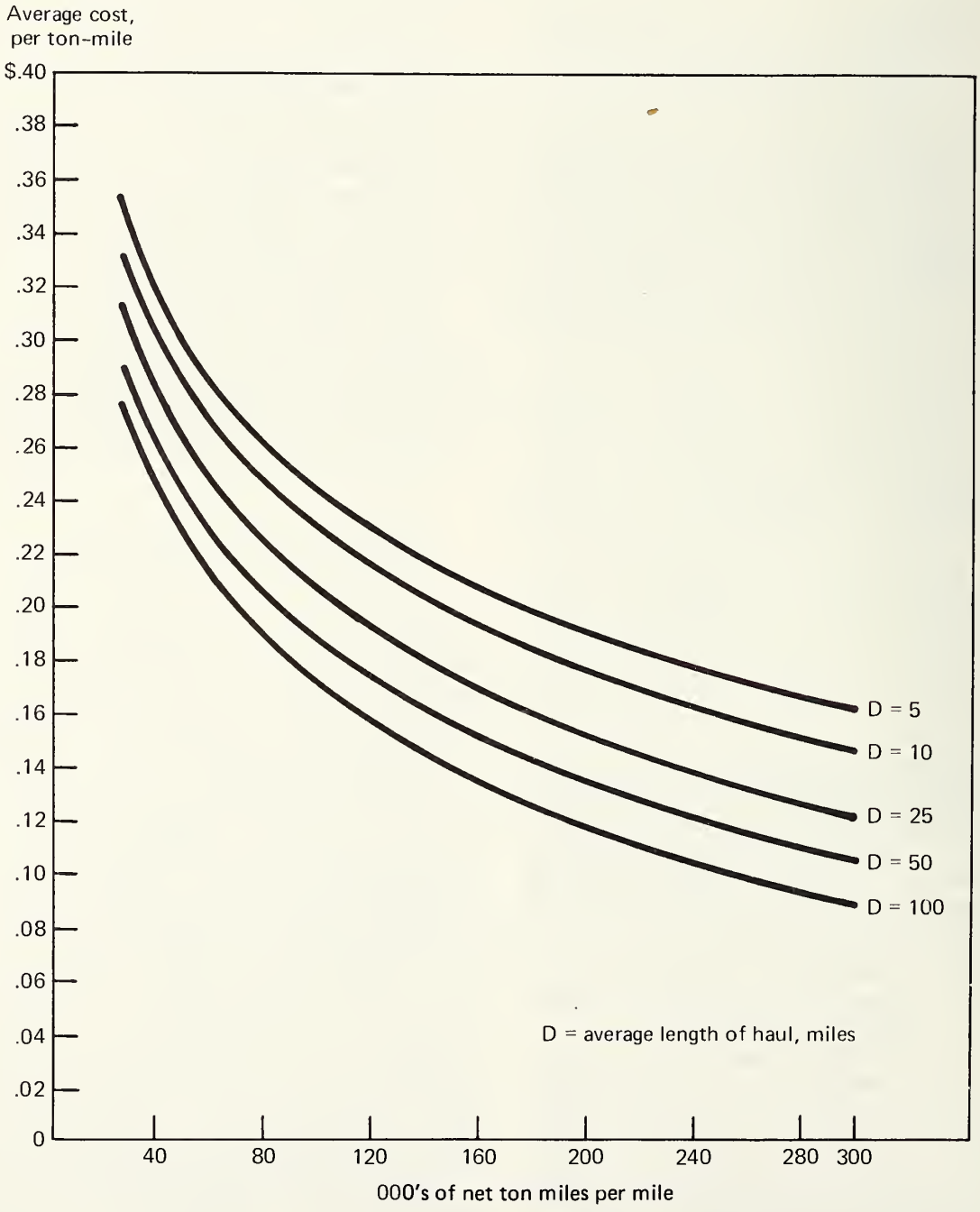


**Figure 1. Estimated average cost functions by distance groups, 1973**

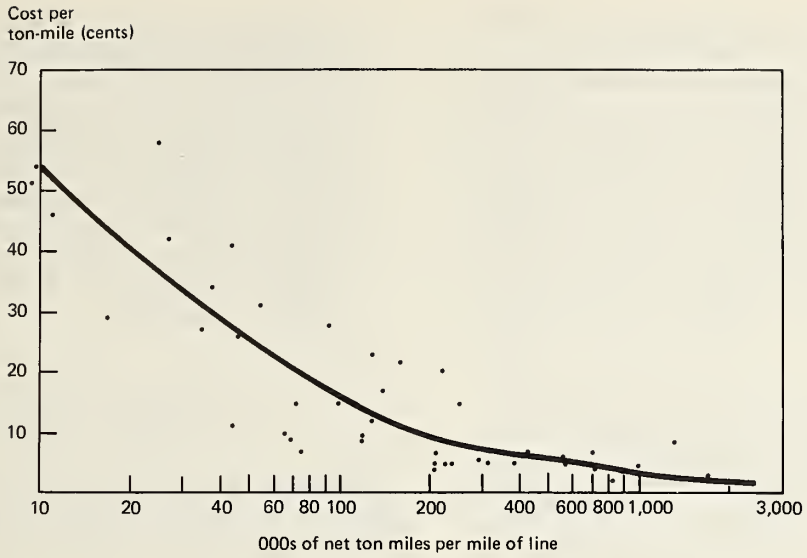


**Figure 2. Relationship of cost per ton-mile and ton-miles per mile of line (unadjusted for distance, sample of Class II railroads, 1973**

Table 1. Length of main line haul necessary for Class II railroads to be economically viable

| Length of Class II road | Cost of Class II haul per ton mile | | | | |
|---|---|---|---|---|---|
| | 2¢ | 4¢ | 6.5¢ | 13¢ | 26¢ |
| | Length of main line haul | | | | |
| 5 | 0 | 10 | 22.5 | 55 | 120 |
| 10 | 0 | 20 | 45 | 110 | 240* |
| 25 | 0 | 50 | 112.5 | 175* | 600* |
| 50 | 0 | 100 | 225 | 550* | 1,200* |
| 100 | 0 | 200 | 450 | 1,100* | 2,200* |

*Indicates that transfer from rail to truck is cheaper, as explained in the text.

Table 2. Distribution of abandoned and surviving lines by volume

| Net ton miles per mile* 000's | Abandoned lines | Surviving lines |
|---|---|---|
| Under 6 | 6 | 0 |
| 6 - 10 | 1 | 2 |
| 11 - 20 | 7 | 7 |
| 21 - 35 | 7 | 11 |
| 36 - 68 | 5 | 5 |
| 69 - 100 | 2 | - |
| Over 100 | 2 | - |
| Total | 30 | 25** |

*Average for fifteen years prior to abandonment or prior to 1969.

**Three roads had averaged over 68,000 tm/m in the 15 year period but not in the last 3 years of the period.

sample was selected partly at random, partly of roads known to be typical of the group. This did not involve econometric analysis, but merely a comparison of various sets of data for the two groups of roads. Table 2 shows the distribution of the two sets by volume.

The major conclusions are as follows:

1. A number of lines have continued to operate for long periods with less traffic than is regarded as necessary for a branch line of a major system.
2. Survival with traffic under 10,000 tm/m—1 or 2 cars a day—is virtually impossible unless the line is extremely short. A line is barely marginal at less than 20,000 tm/m.
3. A line with traffic over 65,000 tm/m and typical costs and rates has an excellent chance of being viable, and one over 100,000 very definitely so, except under unusual circumstances. These

amount to roughly 9 and 16 loaded freight cars per train, 3 times a week operation.

4. Lines between 20,000 and 65,000 tm/m may or may not be able to survive for long periods. The majority of the roads in both samples are in this group. One determinant is the type of commodity and thus the rate; but the most significant is the mileage of the line; this is demonstrated clearly in Table 3 below. No line with traffic under 65,000 tm/m has been able to survive if it exceeds 50 miles in length, and very few in excess of 25.

Table 3. Mileage distribution of abandoned and surviving lines

| Miles | Abandoned lines | Surviving lines |
|---|---|---|
| 5 and under | 2 | 6 |
| 6 - 12 | 5 | 9 |
| 13 - 25 | 9 | 11 |
| 26 - 50 | 9 | 2 |
| 51 - 75 | 1 | 0 |
| 76 - 100 | 1 | 0 |
| Over 100 | 3 | 0 |

5. The evidence suggests that a light traffic line must replace about 100 ties per mile annually—5% of the total—if it is to continue to operate. Tie replacement is usually, but not always, curtailed drastically for several years before abandonment.
6. Typically abandonment does not take place until deficits in net revenue from railway operations have continued for a number of years. Operations continue far beyond the point at which profit optimality, with reasonable expectations, dictates.
7. In a number of cases, abandonment occurred either because of physical damage to line or equipment, or to loss of a major shipper. But the underlying causes were typically decline in forest products output, decline in mining, and loss of traffic to trucks, especially when the volume was low to begin with.
8. Relatively few communities of any size were left without service because of abandonment, but there were several instances. More communities declined in population after abandonment than gained, but many of the former were losing population before abandonment.
9. While there were protests in a majority of cases, these were severe in only eight. While no careful examination of indirect benefits was attempted in the study, the analysis suggests that five of the thirty lines could probably have been justifiably retained, considering indirect benefits, two because of actual and potential industrial traffic, two because of possible future coal developments, one because it left a large region with potential mining development without rail service.

## ALTERNATIVES

While most studies consider the question of alternatives to operation of light traffic lines by major railroad systems, two concentrated on this question:

### 1. Short Line Operation

A study by the Banks firm compared in depth the operation of 6 short line railroads with 6 similar branches of major systems in the same area, with similar characteristics (20). The conclusions reached are as follows:

1. Short lines offer no magic formula; the more prosperous ones would be profitable branches, and many branches of Class I roads could not subsist as short lines.
2. There are, however, certain net advantages. The local line manager can maintain closer relations with shippers, difficult for a major road to duplicate.
3. The greatest savings are in labor costs: the payment of wages on local wage scales instead of nationally negotiated ones based primarily on metropolitan area wages, and much greater flexibility in the use of labor than union contracts permit the major systems.

On the other hand, there are certain disadvantages with regard to equipment repair, use of diesels, and specialized maintenance of way equipment.

A study of various alternatives prepared for the State of Wisconsin revealed another difficulty: in contrast to past attitudes, several of the Class I railroads today are very unsympathetic to transfer of branches to local firms in lieu of abandonment (5).

### 2. Municipal Operation

An indepth study was made of three municipal railroads (6). The City of Prineville Railroad, in central Oregon, has been a highly successful operation, after difficult early years. Built in 1919 and operated by the city throughout, it has enabled Prineville to become a major lumber and milling

center, which it could not otherwise have been. The Belfast and Moosehead Lake Railroad, in the state of Maine, connects Belfast with the Maine Central. Built by the city but operated by the Maine Central for many years, it resumed independent operation in 1924. Since that time, it has been self supporting financially, and has facilitated the growth of the poultry industry in the Belfast area in handling large shipments of incoming grain from the midwest. The third operation, of the Municipality of East Troy in southern Wisconsin, is an extremely small one, handling only about 500 cars a year, but is essential for the town's major industry, a steel tubing plant, many of whose shipments require rail service. The annual deficits are covered by the town. A fourth, the Warrenton, in North Carolina, was not studied in depth; it has shown a small deficit for some years—but under $1000 a year. There is one other relatively new governmental operation, that of the Ogdensburgh Bridge and Port Authority in northern New York State. The studies reveal the major strengths of municipal operation: the ability to support deficits when they occur to keep the line in operation for future developments, the advantages of partial tax exemption, and the fact that the earnings of good years can be used to improve the line and lessen municipal taxes. There has been no evidence whatever of lesser efficiency of operation than that of private firms. There have been some problems, however, in finding suitable management personnel, and, with the very small operations, the inability to have a full time manager.

## IMPACT STUDIES

Major attention has been given to the impact of the abandonment of railway lines upon the communities served. One group of these studies has been concerned with the effects of the abandonments that had previously occurred (1, 3, 7,8, 16, 17, 18 and 26); the other, with potential effects of abandonment of particular lines now in operation (2, 10, 12, 14, 22, 23, 24 and 25). The idea of such studies is not new; the author proposed one to a student for a master's thesis in 1947. The first serious study, however, was that of the effects of the 1962 abandonment of the Rutland, issued in 1966 (18).

The approaches of these various studies of past abandonments differed somewhat, but there were many common elements. One group was based on interviews of shippers, shipper groups, chambers of commerce and local governments, to ascertain the effects on transport costs, plant investment, relocation of plants and activity, investment in roads, and community development generally.

The other approach, used to some extent in all but virtually the sole element in some, employed statistical measures of economic growth such as population, manufacturing output, retail sales, and other indicators, comparing the areas losing rail services with control areas similar in other respects. The difficulties with both approaches are obvious. The former may not give a clear quantitative picture and the biases of the interviewee and interviewer are reflected in the results. With the latter, isolation of other influences is virtually impossible. It is not possible to find control groups that are identical in all respects except the retention of the rail line. More of the affected communities lost population than gained—but in a number of instances the decline in population had started first and precipitated abandonment of the rail line.

The general conclusions of the overall group of studies indicate that the actual abandonments that have occurred have not had significant effect upon the development of the areas served, because of the availability of motor, and in some instances, water, transport. But they have caused economic loss in some instances to shippers whose transport costs are increased materially. The primary adverse effects have been on some grain elevators, fertilizer and feed dealers, and in a few instances, mining and manufacturing operations. The most serious effect in some instances has been to close the door to any future economic development in the area requiring rail service.

The studies of projected abandonments virtually all concentrate on agricultural areas; the general results are (1) that in areas such as Iowa with a dense network of branch lines, there are substantial net gains from concentrating the traffic on a smaller number of lines rebuilt to higher standards, although some shippers and communities will lose; while (2) in areas having only a sparse network and far removed from water transport, the economic costs of abandonment are likely to be substantial. All of necessity use the interview technique, since there are no results to measure.

## MAJOR CONCLUSIONS

These studies suggest several major conclusions:

1. There are very substantial economies of scale as traffic volume increases from very low levels, but many of these economies are exhausted by traffic levels of 140,000 net ton miles per mile of line.
2. Class II railroads with traffic in excess of 200,000 net ton miles per mile—roughly 27 loaded cars a day, three days a week—are economiclly justifiable, even with disregard of externalities, if the main line haul is at all significant. Costs on these lines range from 5 to 7 cents per ton mile; those over 800,000 are as low as 2 cents per ton mile, including capital costs figured on salvage value.

   This conclusion differs sharply from the recent work of Harris and Keeler, which, on the basis

of study of Class I railroad cost functions, suggests that costs are 2 to 3 times as high for these traffic densities.

3. Railroads with traffic under 60,000 ton miles per mile typically have costs in excess of 30 cents a ton mile, and thus are economically justified, without regard to externalities, except if (1) they are very short, at the most 20 miles, and (2) the line haul is substantial. The lower the traffic density, the shorter must be the line, and the longer must be the main line haul, for the line to be justified.
4. Despite the high costs, a number of railroads with traffic under 30,000 ton miles per mile of line have survived for long periods—but only if they are relatively short—under 20 miles or so.
5. The economic viability of a line with traffic under 500,000 ton miles per mile, is therefore a function of:
   a. The length of the line. There are some economies from longer average hauls, but these are much less significant than the disadvantage of the relatively long high-cost haul on the longer roads.
   b. The length of the main line haul.
   c. The cost of transfer of freight from truck to rail.
   d. The nature of the freight insofar as it affects the relative cost and feasibility of handling by various modes.
   e. The actual cost level on the line, in turn influenced by wage levels, flexibility in the use of labor, effectiveness of management, and the conditions affecting track maintenance costs.

   The ability of a Class II railroad to cover costs is also influenced by the value-of-service related influences on the rates of the commodities handled, and by the rate division the road is able to obtain, when it differs from the relative costs, but these elements are not relevant for economic efficiency.
6. The most important externality from retention of a typical light traffic line is to preserve for the community the possibility of attracting rail-requiring activity in the future, plus retention of existing activity of this type. There is also, in some instances, the importance of preserving the advantage of existing rail rates that are the same from points on the line as those from the nearest main line rail stations. In this situation the community can only lose from loss of the branch.
7. National externalities include energy use and pollution gains, and the policy of aiding certain regions.
8. With typical commodities, costs, and main line haul, as a rough approximation, the studies suggest the following traffic volumes as necessary for economic justification for retention of the line, exclusive of externalities, expressed in net ton miles per mile; 2 miles, 12,000 or 5 cars a week; 5 miles, 20,000 or 8 cars a week; 10 miles, 30,000 or 12 cars a week; 25 miles 65,000, or 21 cars; 50 miles, 200,000 or 80 cars; 100 miles, 800,000, or 320 cars. These figures are based on typical situations and ignore externalities. A line with much less traffic may be warranted if the principal commodity cannot feasibly be moved by truck; transfer costs are very high; or operating costs are unusually low. And a community may justifiably, from its standpoint, keep a line via subsidy even though traffic is very low, if the view is accepted that the line is essential for future development for the community. These figures are higher than the ICC 34-car rule but lower than DOT's recent 70 car figure at typical distances.

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# The Federal Role in Local Freight Transportation

Madeleine S. Bloom
Director of the Office of State Rail Programs, Federal Railroad Administration
U.S. Department of Transportation

The intent of this conference is not only to stimulate new research on transportation problems facing agriculture, forestry, and rural areas, but also to reaffirm our common position that these problems are of national concern. While it may appear that the transportation needs of rural America are generated solely in a local or regional context, their impacts, whether environmental, socio-economic, or energy-related, stretch across the nation.

With this idea in mind, I would like to review for you the role of the federal government in rail freight transportation in rural areas. This will include a brief examination of major federal programs developed under recent legislation to financially assist states in resolving local freight service problems and supply the states with a range of options for addressing the problems caused by a loss or potential loss of rail lines.

In an effort to restore vitality to the railroad industry in the Northeast, Congress enacted the Regional Rail Reorganization Act of 1973 (RRR Act). This Act heralded the beginning of major Federal financial assistance for rail freight service. In addition to the establishment of both the United States Railway Association (USRA) and the Consolidated Rail Corporation (ConRail), the RRR Act provided $180 million over a two-year period for the continuation of essential local rail services on light density freight lines in the Northeast and Midwest. To date, funds appropriated for the Northeast and Midwest Region total $48.75 million in FY 1976 and the Transition Quarter, and $63.25 million in FY 1977.

The intent of the RRR Act was to ease the impact of the loss of rail service in the Region, and to provide states and shippers with the time to find permanent solutions to their freight shipment needs. Commonly referred to as the Title IV Program, this rail service continuation program was viewed as a short-term, transitional measure, and not a permanent solution to the problem of light density rail freight service.

The Title IV Program commenced in the Region on April 1, 1976, when ConRail began its operations. Simultaneously, almost 3,000 route miles, which is approximately one-half of the mileage excluded from the ConRail system, continued in operation with Title IV subsidy grants in fourteen states in the Region. To date, the Title IV Program has consisted primarily of subsidies to defray the daily operating deficits on eligible branch lines, and associated lease payments and property tax payments to the trustees of the bankrupt railroads who remain the owners of

the properties. The states are just now embarking on projects to restore the physical condition of many lines.

The RRR Act limited Federal assistance to the Northeast and Midwest. The Railroad Revitalization and Regulatory Reform Act of 1976, enacted into law on February 5, 1976, amended the RRR Act provisions governing assistance to the Northeast and Midwest Region and, at the same time, expanded Federal assistance for light density lines to the remainder of the country. Significant provisions of Title VIII of this recently-enacted law are as follows:

1) All funds are provided to states on a formula basis. Funds may be used as operating subsidies and for capital purposes including the construction or improvement of non-rail facilities as alternatives to the continuation of light density rail services;
2) The program is authorized to extend for five years, with the Title IV Program merging into it after two years. The five-year period will allow the states time for the development of efficient transportation alternatives.
3) The Federal share of funds will decline from 100 percent to 70 percent over the five-year period. The total funding authorized under the Title VIII Program was $360 million which was in addition to the $180 million provided under Title IV. This program is also a transitional one, with Federal support ending after 5 years. The authorized funding and current appropriations are:

Authorized funding

1. $360 million for 5 years (including $5 million per year for first 3 years for planning)
2. Federal share

| | |
|---|---|
| 100% | July 1, 1976-June 30, 1977 |
| 90% | July 1, 1977-June 30, 1978 |
| 80% | July 1, 1978-June 30, 1979 |
| Up to 70% | July 1, 1979-June 30, 1980 |
| Up to 70% | July 1, 1980-June 30, 1981 |

3. 17 States under RRRA became part of RRRRA on April 1, 1978

Current appropriations

FY 1976—$5 million for planning—available now.

FY 1977—$6.7 million for planning and projects—available October 1, 1976.

The administration of the Title VIII Program lies within the Federal Railroad Administration's Office of State Rail Programs. The Federal Railroad Administration organization as it relates to state rail assistance is shown in Figure 1. Federal regulations governing Title VIII were proposed for comment on August 9, 1976, and are currently being finalized. States desiring to submit applications for planning assistance grants are able to do so as prescribed under the proposed rules and regulations. States are the only eligible applicants for this Federal assistance. Eligible projects must be those justified in a state-developed rail plan, and must be a part of, or related to, railroad freight lines on which the Interstate Commerce Commission has made a finding that public convenience and necessity permit the

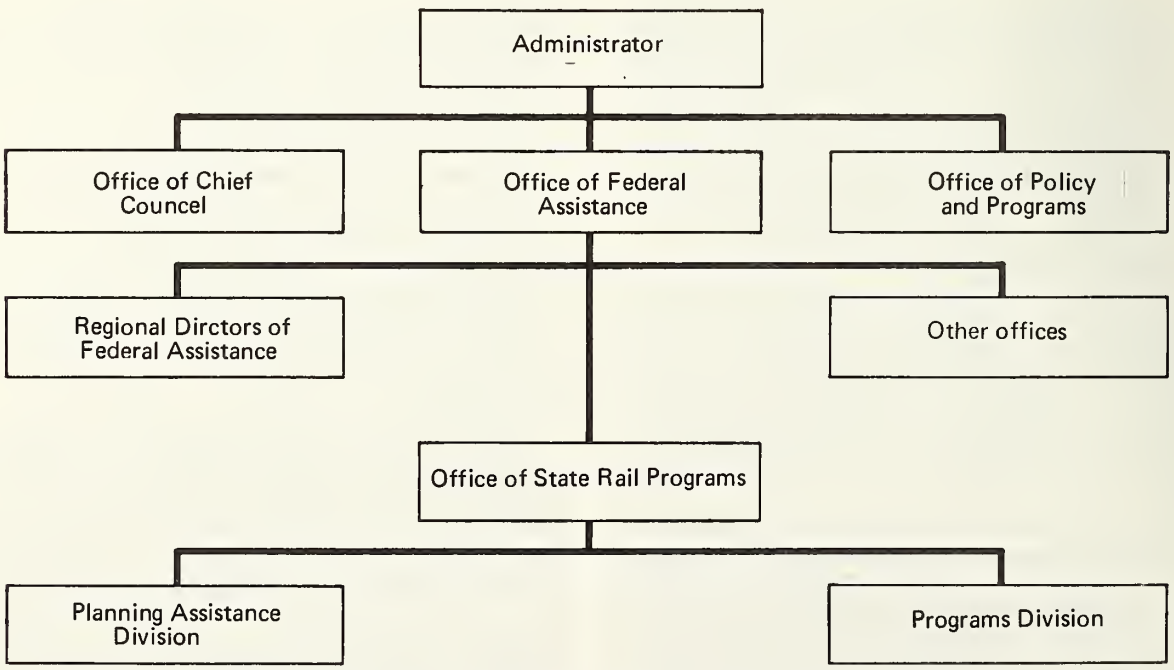


**Figure 1. FRA organization related to state rail assistance**

abandonment or discontinuance of the line or service. As of August 1, 1976, 829 miles of rail line were eligible under the program.

The primary steps that a state must follow to fully participate in the Title VIII Program are as follows:

1. Review State constitution and legislation
2. Designation of State agency
3. Application for planning assistance
4. Develop State rail plan
5. Develop program of projects
6. Application for projects
7. Plan implementation
8. Monitor implementation
9. Revise plan and program

As most light density lines are located in rural areas, and agriculture accounts for more of the traffic originating and terminating on these lines than any other product, the impact of rail abandonments may be felt most heavily in the agricultural sector of the country. Through the use of Title VIII funds, a number of possible responses exist for the rail user or community which may face the possible loss of railroad service. A fundamental beginning for the use of Title VIII dollars is the development of state rail plans, as part of the state's overall transportation planning process. This plan is the tool used by the states to examine the local freight service needs confronting them. It also serves as the technical basis for identifying and justifying projects to be funded. Because many states may have little technical experience in developing state rail plans, the FRA is preparing a *Rail Planning Manual*. Volume I of the *Manual*, a policy overview of rail planning, should be available shortly. Volume II, entitled "Guide For Planners," will concentrate on the management and conduct of technical studies in the field of freight transportation. This volume should be available next summer. It is important to note that these manuals are intended primarily as guides. They are not intended to be regulatory, but rather to aid states in putting together meaningful rail plans.

State rail plans may also be vehicles for state initiation of analytical studies such as a 1973 Iowa effort concerning alternative systems for transportation of harvested grain. The objective of this study, which was conducted by the faculty of the Iowa State University, was to determine which among eleven distribution systems would make the largest contribution towards net revenue per bushel of grain harvested in a 6½ county area surrounding Fort Dodge, Iowa. As an outgrowth of this study, the FRA contracted with the Iowa Department of Transportation in October of 1974 for a study leading to the development of a statewide plan for grain movement. The bulk of the research, which was undertaken by Iowa State University, included a detailed analysis of the social, economic, and environmental aspects of rail transportation, as well as a consideration of interactions with other modes. This plan, which also took into account problems that affect various user groups and the communities served by rail, was issued in March of this year and is available for use by other states faced with similar problems.

Once eligible local rail services have been defined, Title VIII funds can be used in several ways. A first alternative involves the actual subsidization of the service itself. This approach, although generally short-term, may be used on an interim basis while users and affected communities begin the development of more long-term solutions. As a side benefit, a subsidy program of this nature may possibly encourage opportunities for reducing operating costs on the lines. During the subsidy period, innovations could be tried in areas such as changing service frequencies or operating arrangements.

In addition to subsidy, states may use Title VIII funds for physical improvement to lines or for acquisition of rail lines. Physical improvements would be designed to enable compliance with the FRA Class 1 Track Safety Standards, or with higher standards, if justified by a rigorous quantitative analysis. Acquisition of rail freight properties should be justified by a detailed benefit/cost analysis. Both analyses, once again, could be performed as a part of a state rail plan. For those lines with natural resources or traffic potential, but where there is not sufficient demand for current operation, states may wish to rail bank the properties. This involves acquisition of the properties in order to preserve the railroad rights-of-way for future use.

Acquisition of rail lines by a state may involve the establishment of short line operations which could provide more economical service than larger carriers. Short line railroads may possess a greater management incentive and lower overhead costs, and may offer flexibility to shippers that larger railroads are unable to do. Presently, several states in the Northeast Program are experimenting with the concept of a short line operation; however, it is too early to tell how successful this type of operation may be in terms of efficiency and quality of service.

As I have noted, Federal funds are not limited to subsidy solutions. Several states in the program have recently received Federal assistance for the construction of alternate facilities, including new rail connections. For example, one state has received funds to cover both the preliminary engineering and construction of a connection which will allow service to shippers on a far more efficient basis than the subsidization of service over the existing track. Cost savings of up to $500,000, which would have been needed to upgrade the present facility, should be achieved. Similarly, another state has executed a grant of $400,000 with FRA to construct a new connection, rather than subsidize a 27-mile branch line. The state has designed a connection which links the subsidized line with a line of a solvent carrier passing underneath, and is within several miles of all concerned shippers. By removing a bridge, lowering the grade, and building a very short segment of track, the state will eliminate the need to subsidize the line,

thereby saving in the neighborhood of $500,000 to $1,000,000 in potential subsidy payments. In addition, it has been estimated that a 40 percent increase in traffic will result from the construction of this facility.

There are also certain non-rail alternatives which are eligible for Federal assistance, and which should be given careful consideration in rural areas. These alternatives provide a means to continue local freight service through other than rail transportation subsidy methods. For example, rail loading or unloading facilities may be reconstructed to facilitate truck shipments. Also, the approaches to loading facilities from existing highways may be realigned. States could consider upgrading farm-to-market roads or road structures (bridges, culverts, signals) in the vicinity of an abandoned rail line in order to handle increased truck traffic diverted from the rail line.

Consideration should also be given to the use of team tracks, i.e., public tracks. Through the utilization of private sidings which lead off of the branch line and run adjacent to a shipper's facility, groups of shippers could jointly share rail cars positioned on the sidings. Generally, trucks would be used to haul the shipments from the users to the rail cars.

For medium or high-valued freight which is being shipped over long distances, TOFC (trailer-on-flatcar) service is a possible alternative. If goods could be shipped via TOFC, the subsidizer and shipper may find that construction of TOFC loading facilities on a nearby profitable rail segment may be more economical and efficient than subsidizing a non-profitable branch line. The additional miles required to truck a trailer to a loading facility should usually be small and, thus, the incremental cost would be minimal. In addition, the shipper should receive more frequent service when loading on a profitable segment of line than through subsidization of a non-profitable branch.

My remarks today were intended to provide you with an understanding of the Federal programs available to assist states in seeking solutions to local freight transport issues. Although the programs do have restrictions, there is sufficient flexibility to allow states, localities and shippers to develop solutions tailored to specific needs. I hope that this symposium will not only stimulate new research ideas and approaches to rural problems, but that it will also be responsible for developing new tools and techniques of use to states in resolving their local freight problems.

# The Economics of Rural Road Systems

Clyde G. Weller
Regional Transportation Planner, Forest Service
U.S. Department of Agriculture

The purpose of this paper is to sketch the nature of analyses appropriate for determining the economic feasibility of improving local rural highways (roads) for freight movement. This has been an issue of great importance in forested areas for many years. It is also my opinion that it will continue as an issue in rural and agricultural areas.

The prospect for rail abandonment in many areas does, of course, add to the concerns now receiving circulation. On National Forest lands, thousands of miles of railroad existed in the early 1900s, as the first logging was accomplished via that mode, but forest railroads are virtually nonexistent at present.

The scope of this paper will be held to economics (both quantitative and qualitative) with respect to rural road systems.

The use of economic analysis of engineering projects is imperative to evaluate potential projects and to evaluate current management direction, but the economic analysis is useless if financing is not available. For this reason, the cash flow generated by each project is important information for decisionmakers. If one project is economically superior to another but the project requires a prohibitive initial cash outlay, it is not feasible to initiate that project.

Financing of rural roads is an area of analysis that can help define which projects merit economic analysis. It also can force the decisionmaker to select a project showing less favorable economic results. However, it is too complex an area of analysis for me to cover in this brief paper.

## ENGINEERING ECONOMICS

Many variables affect the economic efficiency of engineering projects. Among the more important economic indicators influencing the economic outcome of highway improvements are project life, discount rate, internal rate of return, present worth, and equivalent annual costs. Analysis of any one of these

indicators is not enough to show the economics of a project. It is best to show this by example, which follows under the topic of present value profile.

## Discount Rates

Much debate occurs between the public and private sector with respect to discount or interest rates. The private sector many times must pay up to 12-15 percent to acquire capital to finance construction projects. The public sector, specifically the Forest Service and other Federal agencies, can get money for 6⅞ percent interest (discount) rate. Obviously, it is easier to justify a project at 6⅞ percent than at 12 percent. The Office of Management and Budget has addressed this divergence in discount rates between the public and private sectors and has attempted to equate projects across sectors by requiring Federal projects to be analyzed at a 10 percent discount rate. The Water Resources Council (1973) recommends 7 percent.

In the Southwest Region of the Forest Service, we have a Road and Trail Economics (RTECON) computer program which evaluates projects at 6 percent, 10 percent, and 15 percent discount rates. Each evaluation calculates the present value of benefits, present value of costs, net present worth, and the internal rate of return (IROR) at each discount rate with the project and without the project. Having both with and without project benefits and costs makes the marginal economics easily calculated. The program also calculates marginal benefits, marginal costs, marginal net present worth, and marginal benefit/cost ratios for each discount rate. The question arises, why calculate these economic indicators at different interest rates? The following section of this paper answers this question.

## Present Value Profile

The present value profile is merely the plotting of the net worth of projects calculated at various interest rates. The importance of the present value profile is that it displays several of the economic indicators that economists argue about under alternative assumptions concerning discount rates. Some argue that IROR is best; some, net present worth; some, benefit/cost ratio. It is true that each economic indicator shows something, but any one by itself does not show the whole picture. For example, the cash flows in Figure 1 and the comparable present value profile shows how these economic indicators vary on the same two projects. Project A is economically superior to project B below an interest rate of 11.75 percent, and project B is superior to project A above 11.75 percent interest, with the two projects equivalent at 11.75 percent interest.

An important aspect of the present value profile is that the internal rate of return (IROR) just happens (by definition) to be the discount rate where the net present value is 0. The benefit/cost ratios are shown below the interest rates to indicate their dependence on the discount rate. The cash flow, also an important indicator, must be displayed. Of what value is a B/C ratio of 30:1 if the initial investment cannot be afforded or, just as important, a project with a B/C ratio of 30:1 with an insignificant investment. This gets away from strict economics into finance.

So, this short summary of present value profiles takes into account 90 percent of engineering economics, but calculating the present value profile does not account for much of the total analytical effort. Data acquisition and/or development is the difficult and time-consuming task. The economist should, of course, consult the engineers for much of the data development.

## Costs and Benefits

Benefits and costs can be categorized as qualitative and quantitative. Unfortunately, the only scale of ratings we understand is based on numbers. Thus, we in the Forest Service attempt to rate both qualitative benefits and costs either in dollars or in some other numerical mode. Environmental protection laws have, in some cases, made formerly nonquantifiable variables subject to quantification acceptable in legal circles. Even so, some decisionmakers want other systems of rates, and of course some indicators of concern are not as yet subject to quantification in dollars or other physical standards of measurement.

In some investment analyses the question of who receives the benefits and pays for the costs of the projects may be significant. Even though road investment analyses use aggregate social benefits and costs, the nature and frequency of use by various types of vehicles must be known in order to estimate distributed benefits and costs accurately. An example of this follows with respect to maintenance costs.

Maintenance costs assumed for commercial trucks should be 30 to 35 times that of a pickup or automobile. This was indicated by a study in California on timber haul roads at Cottonwood in the Stanislaus National Forest by the University of California in conjunction with the Transportation Analysis Group (TAG) of the Forest Service in Berkeley. Many of our rural roads are native soil or gravel surfaced, and the maintenance responsibility is still quite difficult to assign. A Forest Service study of assignment of the maintenance responsibility is revealing. The Northwest Region has been costing maintenance at 700 percent more than the Southwest Region. Our Southwest Region has also been losing its roads to wear. On-the-ground research is needed here for a better handle on surface wear on native soil and gravel surface roads.

| Cash flowtime | Project A | | Project B | |
|---|---|---|---|---|
| | Benefits | Costs | Benefits | Costs |
| Initial cost | | $10,000 | | $10,000 |
| Year 1 | $2,000 | | $7,000 | |
| Year 2 | 4,000 | | 5,000 | |
| Year 3 | 6,000 | | 4,000 | |
| Year 4 | 8,000 | | 2,000 | |

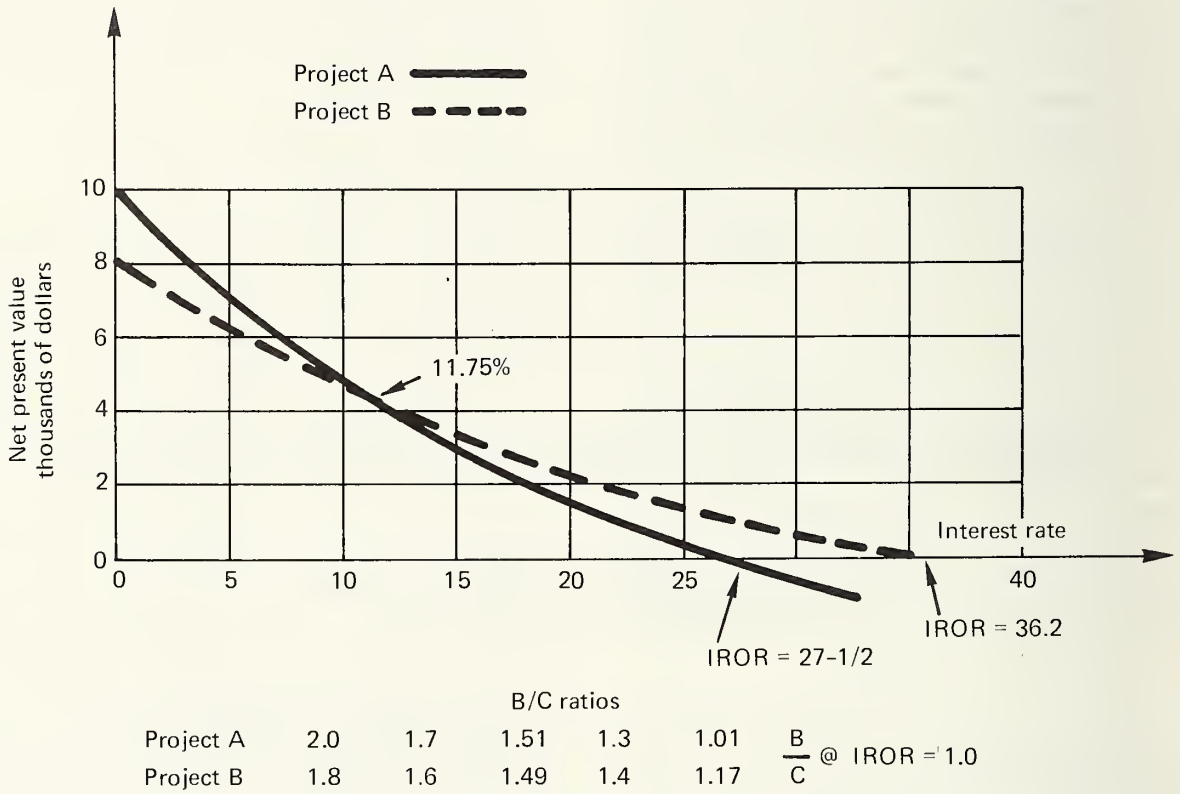


**Figure 1. Economic indicators**

Hauling or operating costs are easier to evaluate, as maintenance of vehicles, speeds on roads, and operating costs per hour are available. The worth of a visitor's time in an automobile is difficult to cost, such as a recreationist. This cost is different from a working man's time.

The reason these terms may be of importance is due to the need in some cases to tax the user for road wear. The States and counties charge user fees and license fees, and the Forest Service charges "timber credits" by allocating part of the stumpage fee for maintenance and hauling costs.

*Quantitative*.—The truly quantifiable benefits and costs are the easiest to handle in the project evaluation. Construction and reconstruction, maintenance, operating, or hauling costs can be quantified. Dollar values can be assigned, and cash flows can be established for an economic analysis.

Much of the economic analysis of Forest Service roads has been computerized for ease of calculation. One standard national computer program for evaluating economic analysis does not exist within the Forest Service. Several of the regions have their own economic analysis package which does the job. The names of these programs are INVEST 3, DAMID, RTECON (Southwest Region), and others which do approximately the same job for capital investments. Figures 2a and 2b show the output for a RTECON run.

* Job sequence No. 3

**********

Summary of project related economics and resource use

Coronado N.F. swift trail (stab.-con.) road No. FH-34

**********

Project related investments and associated yearly benefits and costs

| Year | Activity and resource use considerations | New investment costs | Estimated yearly benefits & costs | | | |
|---|---|---|---|---|---|---|
| | | | With project | | Without project | |
| | | | Benefits | Costs | Benefits | Costs |
| 1974 | Project const. FR+T | 3543750 | | | | |
| 1974 | Project const. TMBR | 0 | | | | |
| | Project maintenance | | | 37926 | | 39990 |
| | Vehicle oper. (avg.) | | 519690 | | 42198 | |
| 1978 | Timber harvest $/yr. | | 201000 | 120760 | 201000 | 121000 |
| 1983 | Timber harvest $/yr. | | 201000 | 120760 | 201000 | 121000 |
| 1988 | Timber harvest $/yr. | | 201000 | 120760 | 201000 | 121000 |
| | Rec., existing sites | | 3075060 | 261926 | 3075060 | 261926 |
| | Soil & watershed | | 0 | 8400 | | 7800 |

Project construction and R/W costs make up 100.0% of the total investment of $3543750 on which this analysis is based.

**********

| Estimated resource use – | With proj. | w/o proj. | With as a % of w/o |
|---|---|---|---|
| Facility length (miles) | 25.8 | 25.8 | 100.0% |
| Timber harvest volume (MMBF) | 20.0 | 20.0 | 100.0% |
| Timber harvest season (months) | 6.0 | 6.0 | 100.0% |
| Average annual recreation use | | | |
| – Total visitor days/year | 580848 | 580848 | 100.0% |
| – % camping | 33.1% | 33.1% | 100.0% |
| – % picnicking | 11.6% | 11.6% | 100.0% |
| – % hunting & fishing | 19.4% | 19.4% | 100.0% |
| – % other rec. use | 22.2% | 22.2% | 100.0% |
| – % special rec. use | 13.8% | 13.8% | 100.0% |
| Average annual road use | | | |
| – Total vehicles/year | 208168 | 208168 | 100.0% |
| – % forest service | 4.1% | 4.1% | 100.0% |
| – % timber use | .0% | .0% | 100.0% |
| – % recreation use | 95.7% | 95.7% | 100.0% |
| – % other use | .1% | .1% | 100.0% |
| Estimated erosion (cubic yds./yr.) | 8400 | 7800 | 107.7% |

**********

**Figure 2a. RTECON Output**

The input forms are set up so that all resource staffs can be called upon to estimate the benefits and costs related to the project in question. Ten pages of input are required to cover all the Forest Service staff inputs. Although this program was originally written for road and trail economic analysis, it is flexible enough to be applicable in analysis of other types of capital investment projects.

Project related economic indicators –

| | Discount rate | Total discounted benefits | Total discounted costs | Net present worth | B/C ratio |
|---|---|---|---|---|---|
| With | 6% | 35547522 | 7487589 | 28059933 | 4.7 |
| project | 10% | 17620431 | 5410200 | 12210232 | 3.3 |
| | 15% | 9826365 | 4288950 | 5537415 | 2.3 |
| Without | 6% | 31492941 | 4399604 | 27093336 | 7.2 |
| project | 10% | 15823384 | 2470812 | 13352572 | 6.4 |
| | 15% | 8966173 | 1516939 | 7449234 | 5.9 |
| With proj. | 6% | 112.9% | 170.2% | 103.6% | 66.3% |
| as a % of | 10% | 111.4% | 219.0% | 91.4% | 50.9% |
| w/o project | 15% | 109.6% | 282.7% | 74.3% | 38.8% |

Internal rate of return with project = 40.5%

Internal rate of return without project is greater than 100%

With proj. I.R.R. not calculated as a percent of w/o proj. I.R.R.

**********

Marginal benefit cost analysis –

(with proj. benefits & costs minus without proj. benefits & costs)

| Discount rate | Marginal discounted benefits | Marginal discounted costs | Marginal net present worth | Marginal benefit/cost ratio |
|---|---|---|---|---|
| 6% | 4054581 | 3087985 | 966596 | 1.3 |
| 10% | 1797048 | 2939388 | -1142339 | .6 |
| 15% | 860192 | 2772010 | -1911818 | .3 |

**********

**Figure 2b. RTECON output**

Much of the data required for the RTECON program can be acquired by using the Forest Service computer network analysis and a "Manual Network Analysis Method" by Weller and Tangeman. These programs will be covered later in this paper under NETWORK ANALYSES.

*Qualitative*.—Here, we come to more difficult areas than pure mathematics and numbers. Now, we are involved in emotions, psychology, biases, all seemingly nonquantifiable; but do we really want to quantify these nonquantifiables, such as esthetics, fire hazard, fire risk, geology, wildlife, etc.? Many economists, transportation planners, land use planners, etc., have come to use a type of orthogonal rating called cross classification. Oglesby calls it a Factor Weighting Method. I call it an ordering of biases. Table 1 is an example of cross classification with the addition of priorities and a multiplier for more important resource impacts. The beauty of this

Table 1. Environmental evaluation of alternate routes for Forest Highway 12 from Senorita Divide to Fenton Lake

| Resource or other environmental consideration | Decisionmaker's priority | | Alternate routes | | | |
|---|---|---|---|---|---|---|
| | Rank | Multiplier | 6 | 7 | 10 | 20 |
| | | | Ratings of staff (-10 to +10) | | | |
| Soils | H | 3 | -7 | 0 | -7 | 0 |
| Hydrology | H | 3 | -5 | -2 | -10 | -2 |
| Geology | M | 2 | +4 | 0 | +5 | +5 |
| Timber | H | 3 | +8 | +4 | +6 | +8 |
| Range | M | 2 | -5 | -1 | -8 | -5 |
| Recreation development | M | 2 | +3 | +6 | +6 | +3 |
| Recreation dispersal | M | 2 | +7 | +5 | +7 | +8 |
| Transportation system | H | 3 | +8 | 0 | +9 | +10 |
| Esthetics | M-H | 2½ | +5 | +5 | +4 | +8 |
| Fire hazard | M | 2 | -10 | 0 | -5 | -5 |
| Fire risk | L | 1 | -10 | -2 | -5 | -5 |
| Administrative | M | 2 | +7 | +8 | +5 | +7 |
| Wildlife | H | 3 | -7 | -1 | -10 | -2 |
| L.W.C.F. lands | L | 1 | -2 | -8 | -8 | -8 |
| Sum of ratings | – | – | -4 | +14 | -11 | +22 |
| Sum of (priority multiplier x staff ratings) | – | – | +4 | +42 | -19 | +75 |

form of project ordering is that all the Forest Service transportation planner does is to organize the views of other staff officers and managers into a systematic format for the information of the decisionmaker. Each staff member rates each alternate project as he sees it. The rater must rate the project plus 10 to minus 10 for his area of expertise. Each staff person must do his rating separately. We do not like to mix up their biases. Then we ask management to analyze the priorities of each resource, and we help the manager devise a multiplier for each. The priority ratings can be high, medium, and low, one through the number of resources rated or any combination that suits. The multipliers can drastically change ratings. One resource rating, then, can sway a whole vector of ratings, but that becomes the case when a particular project would pass through the wildlife habitat of the endangered species "catterwaller."

To continue on, the ratings of each staff person are gathered and put in the matrix; priorities and multipliers are assigned; the adjusted rating is calculated; the sum of the adjusted ratings is calculated; and the alternate projects are ordered. The above enumerated technique is a form of the "Delphi Method" for gathering and evaluating expert opinions.

Our Transportation Analysis Group in Berkeley, California, is currently computerizing this technique with matrix algebra (Investment Framework for Decisionmaking). I currently am of the opinion that computerizing this aspect of planning is not wise. The subjective ratings are not any more accurate or more realistic when massaged with a computer.

## TRANSPORTATION SYSTEMS PLANNING AS PART OF LAND USE PLANNING

Transportation systems planning cannot be entirely separated from the Land Use Planning, Urban Planning, Multiple Use Planning, Resource Planning, Rural Planning, or Regional Planning process. Several minimum requirements for transportation systems planning must be established to allow for transportation systems planning and alternative formulations with respect to land use alternatives. The following list of charts, graphs, and maps must be inventoried, plus all the resource inventory maps, to be able to start planning:

Traffic use diagram
Timber harvest haul map
Crop harvest haul maps
Resource maps
Existing road standards map
Traffic classification chart
Existing haul costs and maintenance costs

The following maps and charts should be prepared for each land management alternative:

Traffic trend charts (seasonal and daily variations)
Thirtieth design hourly traffic plot
Forecasted 20-year traffic use map
Forecasted 20-year crop harvest haul maps
Off-road vehicle use plan map
Alternate road system proposals
Road and trail maintenance costs
Haul cost analysis
Construction and reconstruction costs
Economic analysis of each alternative

One could continue at length about the transportation system—land use planning coordination, but this is all that will be covered in this treatise.

## NETWORK ANALYSES (HAUL OR OPERATING COSTS)

Network analyses are run to gain knowledge of the time, distance, and/or costs with respect to various routes in a road network or a multimodal network. Multimodal systems are being discussed extensively as the hunt for the most economical system continues. Where only one mode is available, the analysis is simplified. This paper deals only with the economics of rural road systems; therefore, I will avoid the issue of multimodal network analyses and stick to road network analyses. It should be pointed out that the logic is not different with single-mode analyses, only less complicated.

Network analysis is merely an economic study in that it deals directly with the thrifty and efficient use of material resources. The most economic route from one location to another is usually determined by one of the three indicators; time, distance, or cost. These three indicators of efficiency of operation can be calculated for any network or road system either manually or by a computer. The Forest Service, as well as many other organizations responsible for road construction and maintenance, have computer programs and manual network analyses methods.

### Manual Network Analysis

Many networks are too small to justify using the computer for analysis. Recognizing the capabilities, limitations, and applications of the computer is one of the main attributes transportation planners must have. There is no logical reason to use the computer to analyze a network for an area which has one timber sale, one sawmill, and only three possible routes between the two. Manual network analysis obviously has its place in many rural road systems. In the Forest Service we have many areas which fall into the simple network classification, as do many counties and some States. In the Forest Service we have a "Manual Network Analysis Method for Timber Sales" by Ronald Tangeman and Clyde Weller. This network analysis method is used for calculating appraisal routes for timber sales (from the sale to the closest mill), evaluating project cost effectiveness, and evaluating road upgrading effectiveness. It is a transportation planning tool. In this manual network analysis method, all forest roads are divided into 320 classes from two-lane, paved, excellent alignment to primitive-surface, primitive-alignment roads. All grade ranges from 0 to 10 plus percent (both adverse and favorable) are included in the road classifications (Table 2); a table of road speeds in each direction is used to calculate round-trip travel time for the road class (Table 3); the round-trip travel time is then used to calculate round-trip travel costs at short, medium, and long haul distances (Table 4). Explanation of this figure is that there is a fixed cost of hauling regardless of the distance of haul. The line-haul portion appears to have some taper, but for ease of analysis it is interpreted by linear segments (Figure 3). The break-over points between segments here are set at one and 30 miles. The economics of haul is normally based on the least cost route, which is normally the same as the least time route.

### Computer Network Analysis

No difference exists between manual and computer logic in the network analysis, except much more complicated networks can be analyzed on the computer. Also, once the network is on file in the computer great flexibility exists for project analysis. All point-to-point best routes can be calculated at the bat of an eye. The difficult portion is establishing the file on the computer. Optimization is easy; and many variables can be analyzed rapidly, with sensitivity analysis being quickly accomplished. It should be stated again that no difference exists between the manual and computer analysis. The above tables and figures which were used in the manual method can be easily filed on the computer.

## MAINTENANCE AND CONSTRUCTION COSTS

Maintenance and construction costs are two costs which can be quantified to varying degrees.

### Maintenance Costs

Maintenance costs are difficult to pin down, for there are at least two ways of looking at them. One way is to cost maintenance at that amount you pay for the annual work. This method may or may not cover the amortization of the surfacing, which in

Table 2. Road haul classes by number of lanes, road surface, alignment and grade attributes

| No. of lanes | Road surface | Horizontal alignment | Average grade in direction of haul | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | % Adverse grade (+) | | | | % Favorable grade (-) | | | |
| | | | >10 | 10-7 | 7-4 | 4-0 | 0-4 | 4-7 | 7-10 | >10 |
| | -A- | A-Excellent | 8 | 6 | 4 | 2 | 1 | 3 | 5 | 7 |
| | | B-Good | 16 | 14 | 12 | 10 | 9 | 11 | 13 | 15 |
| | Paved | C-Fair | 24 | 22 | 20 | 18 | 17 | 19 | 21 | 23 |
| | | D-Poor | 32 | 30 | 28 | 26 | 25 | 27 | 29 | 31 |
| | -B- | A-Excellent | 40 | 38 | 36 | 34 | 33 | 35 | 37 | 39 |
| | | B-Good | 48 | 46 | 44 | 42 | 41 | 43 | 45 | 47 |
| 2 | Gravel | C-Fair | 56 | 54 | 52 | 50 | 49 | 51 | 53 | 55 |
| | | D-Poor | 64 | 62 | 60 | 58 | 57 | 59 | 61 | 63 |
| | -C- | E-Excellent | 72 | 70 | 68 | 66 | 65 | 67 | 69 | 71 |
| | Graded | B-Good | 80 | 78 | 76 | 74 | 73 | 75 | 77 | 79 |
| | and | C-Fair | 88 | 86 | 84 | 82 | 81 | 83 | 85 | 87 |
| | drained | D-Poor | 96 | 94 | 92 | 90 | 89 | 91 | 93 | 95 |
| | -A- | A-Excellent | 104 | 102 | 100 | 98 | 97 | 99 | 101 | 103 |
| | | B-Good | 112 | 110 | 108 | 106 | 105 | 107 | 109 | 111 |
| | Paved | C-Fair | 120 | 118 | 116 | 114 | 113 | 115 | 117 | 119 |
| | | D-Poor | 128 | 126 | 124 | 122 | 121 | 123 | 125 | 127 |
| | -B- | A-Excellent | 136 | 134 | 132 | 130 | 129 | 131 | 133 | 135 |
| | | B-Good | 144 | 142 | 140 | 138 | 137 | 139 | 141 | 143 |
| 1-1/2 | Gravel | C-Fair | 152 | 150 | 148 | 146 | 145 | 147 | 149 | 151 |
| | | D-Poor | 160 | 158 | 156 | 154 | 153 | 155 | 157 | 159 |
| | -C- | A-Excellent | 168 | 166 | 164 | 162 | 161 | 163 | 165 | 167 |
| | Graded | B-Good | 176 | 174 | 172 | 170 | 169 | 171 | 173 | 175 |
| | and | C-Fair | 184 | 182 | 180 | 178 | 177 | 179 | 181 | 183 |
| | drained | D-Poor | 192 | 190 | 188 | 186 | 185 | 187 | 189 | 191 |
| | -A- | A-Excellent | 200 | 198 | 196 | 194 | 193 | 195 | 197 | 199 |
| | | B-Good | 208 | 206 | 204 | 202 | 201 | 203 | 205 | 207 |
| | Paved | C-Fair | 216 | 214 | 212 | 210 | 209 | 211 | 213 | 215 |
| | | D-Poor | 224 | 222 | 220 | 218 | 217 | 219 | 221 | 223 |
| | -B- | A-Excellent | 232 | 230 | 228 | 226 | 225 | 227 | 229 | 231 |
| | | B-Good | 240 | 238 | 236 | 234 | 233 | 235 | 237 | 239 |
| | Gravel | C-Fair | 248 | 246 | 244 | 242 | 241 | 243 | 245 | 247 |
| | | D-Poor | 256 | 254 | 252 | 250 | 249 | 251 | 253 | 255 |
| | -C- | B-Good | 264 | 262 | 260 | 258 | 257 | 259 | 261 | 263 |
| 1 | Graded | C-Fair | 272 | 270 | 268 | 266 | 265 | 267 | 269 | 271 |
| | and | D-Poor | 280 | 278 | 276 | 274 | 273 | 275 | 277 | 279 |
| | drained | E-Primitive | 288 | 286 | 284 | 282 | 281 | 283 | 285 | 287 |
| | -D- | B-Good | 296 | 294 | 292 | 290 | 289 | 291 | 293 | 295 |
| | | C-Fair | 304 | 302 | 300 | 298 | 297 | 299 | 301 | 303 |
| | Primitive | D-Poor | 312 | 310 | 308 | 306 | 305 | 307 | 309 | 311 |
| | | E-Primitive | 320 | 318 | 316 | 314 | 313 | 315 | 317 | 319 |

Table 3. Round trip travel time in minutes per mile for "on highway" logging trucks by selected haul classes of roads

| Haul class | Min./ mile | Haul class | Min./ mile | Haul class | Min./ mile | Haul class | Min./ mile | Haul class | Min./ mile |
|---|---|---|---|---|---|---|---|---|---|
| 161 | 3.53 | 193 | 3.43 | 225 | 4.00 | 257 | 5.00 | 289 | 6.00 |
| 162 | 3.53 | 194 | 3.43 | 226 | 4.00 | 258 | 5.00 | 290 | 6.00 |
| 163 | 4.14 | 195 | 4.04 | 227 | 4.45 | 259 | 5.23 | 291 | 6.33 |
| 164 | 5.08 | 196 | 5.14 | 228 | 6.06 | 260 | 6.79 | 292 | 8.00 |
| 165 | 5.03 | 197 | 5.14 | 229 | 5.38 | 261 | 6.14 | 293 | 7.47 |
| 166 | 7.16 | 198 | 8.00 | 230 | 8.61 | 262 | 10.20 | 294 | 14.29 |

itself can double the cost of the maintenance figure. This method can leave you without a road in future years (a loss of the original investment).

The second method, which in my opinion is more responsible (but does not allow for politically imposed cost reductions), includes surface replacement with the annual maintenance cost.

### Construction Costs

The construction or reconstruction costs must be included in project analysis for network analysis. At present most road construction work in the Forest Service is reconstruction of existing roads. Very little construction in virgin territory exists, but our old roads are of poor standard or have degraded to the point that reconstruction is required. Much of this is due to political moves to reduce budgets, with maintenance dollars being the first to bite the dust. The roads then turn to dust. In some areas, reconstruction costs are twice as much as the original construction costs due to the material haul costs required to bring the surface to grade.

## OPTIMIZATION

To optimize the economics of a road system, all three costs (operations, maintenance, and construction) must be weighed for all viable routes and all viable road surface types. Table 5 summarizes these costs for several alternate routes. Many computer programs have been written to analyze the cost op-

Table 4. Round trip haul cost per thousand board feet miles for "on highway" logging trucks, selected haul classes and distances

| Haul class | Distance | | | Haul class | Distance | | |
|---|---|---|---|---|---|---|---|
| | 0-1 mile | 1.1-30 miles | 30.0+ miles | | 0-1 mile | 1.1-30 miles | 30.0+ miles |
| | Dollars | | | | Dollars | | |
| 257 | 1.6667 | .4167 | .2500 | 289 | 2.0000 | .5000 | .3000 |
| 258 | 1.667 | .4167 | .2500 | 290 | 2.0000 | .5000 | .3000 |
| 259 | 1.7424 | .4356 | .2614 | 291 | 2.1111 | .5278 | .3167 |
| 260 | 2.2619 | .5655 | .3393 | 292 | 2.6667 | .6667 | .4009 |
| 261 | 2.0460 | .5115 | .3069 | 293 | 2.4908 | .6227 | .3736 |
| 262 | 3.0000 | .8497 | .5098 | 294 | 3.0000 | 1.1905 | .7143 |

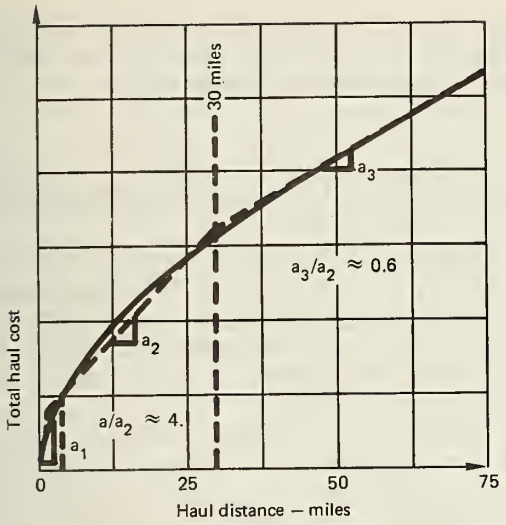


**Figure 3. Haul cost-distance relationship**

timization of alternate routes or alternate solutions. The Forest Service has a program for timber haul (TIMBRI) which optimizes haul, maintenance, and construction costs for a road network. The problem boils down to economically quantifiable variables for which you can establish a cash flow and can calculate the economic indicators involved, nonquantifiable variables which must be subjectively rated, and political variables which may override both of the above.

So upgrading of roads depends on several factors, not all of which are economic in nature.

The first reason for upgrading roads or road systems should be economic in nature and deals with the efficiencies enumerated above (time, distance, and cost). The second reason for upgrading is that of safety. Federal statutes and legal cases make road managers acutely aware of their responsibilities. The third, which is general land use oriented, is that of environmental. The environment is of major concern, and many of the economic benefits are attributable to environmental care. The fourth and most feared by road managers is that of political reasons. It is difficult to be a good businessman with political chess games being played with the road management system. The important point to emphasize here is that we recognize the impact of politics and be prepared with alternate viable solutions. The finance of road management is more closely tied to politics than it is to economics. That sounds like blasphemy, but I think it is true. Probably the most logical way of optimizing or upgrading roads is some combination of the above four reasons for upgrading. A hierarchy of the reasons may be established, but I believe it is impossible to generalize on the relative importance of economic, safety, environmental, and political factors.

## SUMMARY

The economics of road systems is complex but not impossible to compute. The optimization of alternate routes or alternate systems must be based on the best blend of the optimizing rationales: (1) efficiency, (2) safety, (3) environmental, and (4) political.

The optimizing rationales can all be gauged or weighed. Efficiency can be calculated in time and cost (which are almost equivalent) and/or distance savings. The costs and benefits portion is the most

Table 5. Total road haul cost optimization, network analysis

| Mill | Route | Haul cost | | Maintenance | | Construction | | Total |
|---|---|---|---|---|---|---|---|---|
| | | $/MBF | Dollars | Miles | Dollars | Miles | Dollars | Dollars |
| 1 | A | 16.77 | 58,695 | 12.4 | 9,300 | 2.8 | 15,400 | 83,395 |
| | B | 21.97 | 76,895 | 22.0 | 16,500 | 2.8 | 15,400 | 108,795 |
| | C | 33.00 | 115,500 | 40.5 | 30,400 | 4.4 | 24,200 | 170,100 |
| | D | 32.31 | 113,085 | 44.3 | 33,200 | 4.4 | 24,200 | 170,485 |
| 2 | A | 19.55 | 68,425 | 12.4 | 9,300 | 2.8 | 15,400 | 93,125 |
| | B | 24.75 | 86,625 | 22.0 | 16,500 | 2.8 | 15,400 | 118,525 |
| | C | 29.91 | 104,685 | 40.5 | 30,400 | 4.4 | 24,200 | 159,285 |
| | D | 29.22 | 102,270 | 44.3 | 33,200 | 4.4 | 24,200 | 159,670 |

important of the three efficiencies to the American public. The economics of costs and benefits should be shown by several economic indicators: (1) present value profile which includes internal rate of return, present worth at all discount rates, and a continuous modification of the economic relationship between projects (or alternate solutions); (2) benefit/cost ratios at several discount rates; and (3) the cash flow of each or all feasible solutions and the marginal economics of each alternate system with respect to the null option.

Safety is a very nebulous variable, as drivers tend to drive as carefully as road conditions force them to. The main safety hazard which must be avoided is quick changes of any kind.

The environmental characteristics have been impressed upon us lately more than ever before. All possible environmental concerns should be evaluated for all alternate solutions. The cross-classification matrix analysis tool is very easy and applicable for nonquantifiable subjective characteristics.

The fourth characteristic of politics is addressed better now than ever before. Public involvement, public hearings, Sierra Club, etc., have become household terms. I feel it has helped management do a better planning job in that a broader spectrum of considerations are now analyzed before decision-making takes place.

Therefore, it is imperative that all variables be analyzed, both quantitative and qualitative, to approach ultimate land management goals.

## CONCLUSIONS AND RECOMMENDATIONS

C1. Both quantitative and qualitative variables exist in road systems planning and management.

R1. Evaluate the qualitative variables separately in a subjective cross-classification matrix framework and evaluate the quantitative variables with all the rigor economics affords.

C2. Past economic analyses have been deficient in showing all the economic indicators for alternate projects or proposals.

R2. Economic studies should include (1) cash flows, (2) present value profiles, (3) benefit/cost ratios for several discount rates, and (4) marginal economic indicators.

C3. Many past studies have avoided one or more of the economic considerations in optimization, such as construction or reconstruction, maintenance, and operations costs and all area benefits.

R3. Optimization of all economic factors (costs and benefits) is necessary. If alternate routes are presented, avoid showing benefits accruing to one alternate if they are foregone on an existing route.

# Discussion

DR. TYRCHNIEWICZ: Before proceeding with questions from the floor, I thought I would give the members of the panel an opportunity to raise questions with one another, if any of them felt so inclined to take issue with one another. Marc would like to make a comment.

DR. MARC JOHNSON: I want to say one thing, and that is that Phil Baumel, Arvin Bunker and Lowell Hill in their approaches to line analysis use a technique for determining net benefits very similar to what I was talking about. I was gearing my criticism basically to the state rail plans that had been provided to the U. S. DOT for review.

DR. BAUMEL: I am pleased to hear that.

MR. MARK JELAVICH (Jack Faucett Associates, Washington): Dr. Due brought up the possibility of some short lines being bought up by consortiums of firms served along the lines. I recall vaguely that about three years ago an article in BUSINESS WEEK dealt with an entrepreneur in the Middle West who was fairly successful in setting up these short lines. I am addressing this question essentially to Ms. Bloom. In the state rail plans or within the Federal Railroad Administration, has there been any effort to try to encourage this type of development as an alternative, that is, having firms along the line buy out that line and try to run it essentially as a subsidiary business.

MS. BLOOM: I think the answer to that is no. We view the state rail planning process and the development of a state rail plan as a state option. The mix of services or types of projects included are up to the state. We don't encourage them to go into subsidy versus acquisition versus rehabilitation efforts.

I would say one thing, though: Money that the federal government has is only available to the state. We would not provide the money to shippers or to groups of firms for purchasing lines.

MR. JERRY E. FRUIN (University of Minnesota): My question is for Dr. Baumel. We assume in our logical world that, should we abandon 63 rail lines and everything goes by unit train, Iowa will get the $42 million in benefits. I would like your comments as to who would actually get those benefits. It seems to me that by definition farmers will incur additional hauling cost expenses and there will be some additional road costs. In addition, as I look at the market structure situation, there is a good possibility that the increase in total revenue might accrue basically to the elevator operators or the major grain

trading companies and that really we won't see very much of it at all flowing back into the communities.

DR. BAUMEL: This is a very good question, of course. You recall that we had about three or four elements of the benefits and the costs laid out in a previous slide. The net benefit to grain shippers included all of the costs that we could identify in the movement of grain, including the rail rates, the additional handling if there was a double handling, the trucking costs off farms, which I didn't go over, and the trucking costs from one elevator to another. It included price reductions if the best alternative was to go to a market which paid a lower price.

The question of who would get those net benefits is, I think, best answered by saying that unless the farmers get some share of it, they are not going to haul that additional distance. To the extent that these facilities are owned by cooperatives, which in turn are owned by farmers, those earnings should be passed on to the farmer. Certainly the owners of the facilities are going to have to have an incentive as well. Costs were deducted for building the facilities to handle these larger size shipments. The evidence that we have thus far indicates that farmers are indeed sharing in the net benefits because they are trucking longer distances and an increasing proportion of the grain being shipped out of Iowa is going in unit trains.

There was an article in the November 8 industrial issue of BUSINESS WEEK that was entitled "Rails Unlock Iowa Grain," and it dealt with this very question that you have raised. They interviewed a number of elevator operators, at least one university professor, the major grain companies, and some railroad, barge and other people. The conclusion clearly was that the farmers are going to benefit from this, and all the evidence that we see in Iowa indicates that they will.

Let's go to the fertilizer costs. These are clearly a net addition to cost. Farmers or the fertilizer dealers on these abandoned lines are going to incur that additional cost of trucking that fertilizer into those retail facilities. No doubt about that. I am not sure that those fertilizer dealers can pass those costs on to the farmer because the farmer has the option of going to a competitor. My guess is that the fertilizer dealers will have to absorb that additional cost.

The handlers of other products will almost certainly incur those additional costs. Take lumber, for example. Lumber comes into Iowa and into almost all areas of the United States under blanket rates, where the rate over a large area is identical. Therefore, there is no possible rate reduction for getting it at a station that is ten miles west of you. If the lumber comes from the west, you would think that the rate into a town west of you might be less than where you are, but that isn't the case. To the extent that competition won't let them pass it on, lumber dealers are going to have to incur that additional cost.

The costs of upgrading those rail lines are either going to be incurred by the railroads or the public. Given the depressed earnings of the railroads, upgrading costs, in my opinion, are going to have to be incurred by the public. Therefore, the savings from not upgrading will almost certainly, or in many cases, accrue to the public through lower taxes. I am assuming that those tax savings can either be passed back to the taxpayer or used for some alternative investment which will yield a higher rate of return.

The distribution of those savings is mixed but on balance the farmers are certainly going to come out ahead.

Let me add one other point that I didn't deal with, and that was the question of the roads. While we did not include road impacts in this model they should be included and we are hoping to do some work in the near future which will deal with the additional costs to the highways.

MR. LEONARD A. POTH (University of South Dakota): Dr. Baumel, if I read your study correctly, you projected your grain and fertilizer figures into 1980. I suspect that you used a ten-year average or 15-year average and dealt with the current data. I would like to have you discuss why you did that. Do you have guaranteed rain or some such thing?

Then also, right with that, you used 1974 costs. We kind of wrote 1974 off as a very bad year with the recession and the grain embargo and a few other things. You used 1980 grain figures and 1974 costs and I wonder if you would like to discuss that.

DR. BAUMEL: Yes, this is an interesting question. First of all, we had flows of product by seven-digit STCC code into every station in Iowa for the period beginning, I believe, January 1, 1972 through August of '74. Now about half of that 32 month period of time was prior to the Russian wheat sale. Therefore, grain movements would have been lower than almost any of us would have expected. Most of us would agree that grain production is going to continue to remain high and if we generate some new technology corn yield will increase and soybean yields will increase. That is, of course, assuming that we get some rain. I guess all of it is based on the assumption that it is going to rain sometime in Iowa. We don't know when, but we do hope to get rain sometime.

Our data, in our opinion, showed a very low level of product movement out of these stations during '72 and most of '73 because during this period Iowa farmers were holding grain in their bins. The first Russian sale was wheat and Iowa farmers did not participate in the early Russian grain movement but did participate late in '73 and to a large extent in '74 and '75. Therefore, we felt that we had to project ahead to what most people expected to be significantly increased movements of grain off of Iowa farms and out of Iowa elevators.

Regarding the question of the '74 costs, we had to use some kind of cost level. Generally, economists like to deal with a constant cost, and we kept all costs at mid-1974 levels. It would have been extremely difficult to have projected these to 1980.

MR. MORRIS H. TAYLOR (Utah State University): Phil and also others, I haven't heard you say much with respect to what all this branch line abandonment is going to do with respect to contributing toward the viability of a railroad system and its complementary position in regard to future rural economic development.

DR. BAUMEL: I will take the first crack at that, if you would like, Morris. In the analysis that we did, you will notice that on the definition of the benefit-cost ratio, the numerator was benefit to the shippers, strictly the shippers. We didn't include any benefit to the railroad from abandonment or upgrading. The denominator was strictly the investment cost and the fixed maintenance costs for a given rail line.

We weren't concerned about whether the railroads or the shippers or the state or the federal government upgraded that rail line. Somebody had to come up with some bucks to put that rail line in shape and our objective was to try to estimate a return on that investment. We weren't concerned about who made that investment, but more particularly with what kind of return to shippers might be expected from that additional investment in that rail line.

DR. TYRCHNIEWICZ: Would anyone else like to comment on that one?

MS. BLOOM: Yes, just very briefly. It seems to me that from a federal perspective, as contained in the 4-R act, the restructuring process also included an expedited abandonment process provided within Section 802 of that act. The ICC has recently put out regulations under that provision. These regulations, I believe, have the implication that if railroads comply with the process set forth by the ICC, it will relieve them of some of the burden of running uneconomic lines. While one would think this process would be beneficial to them I think the jury is still out on the issue.

DR. DUE: I think if the appropriate formulas are used which consider the effect on the railroad system, the abandonment of lines that clearly are losing money will strengthen the railway system and not weaken it. It sometimes looks as though, if you cut off branch after branch, in the end you have nothing left, and this element obviously has to be considered in the formula. However, I think with the appropriate formula there isn't any danger of that. There will be a net gain in strengthening the railroad system.

MR. B. G. BULLARD (Federal Highway Administration): I don't have a question but I did make an observation and I want all of you people to witness this. Mr. Weller said that the Forest Service is building 7,000 miles of road a year and we in FHWA are getting blamed for paving the country. I just think if they are going to build all that mileage that they ought to take some of the blame also.

MR. WELLER: One of the main projects that I am currently working on is the reduction of road densities. We have some areas that have as much as 15 miles of road per square mile. As a result of this project we are now reducing the amount of roads in many areas.

This last year we have reduced the movement of some sales from 40 miles to 13 miles. Our manual network analysis is basically set up for the timber department of the Forest Service to use in their appraisals for timber sales. We are noting reductions in road densities as a result.

I think the 7,000 miles mentioned also included reconstruction. But we do have a lot of virgin areas where we haven't harvested timber before. These areas, of course, will require some road construction to permit timber harvesting.

MR. ROBERT FETTER (Southern Railway): This is to Mr. Weller. In the very elaborate set of procedures you went through, there was one place where you separated out the number and type of users. If I was reading that chart right it indicated that about 95 percent of the vehicles were not timber harvesting vehicles. Did I understand that correctly?

MR. WELLER: Yes.

MR. FETTER: All right. I'm interested in those charts in which you dealt with gradients in favor of and against the hauls. To what extent do you take account of the fact that it might be desirable for a timber truck to have a grade under three percent while the balance of those users could run with a much more severe grade of, say, six percent. How can that be charged off against timber harvesting?

MR. WELLER: The particular project I analyzed happened to be a recreational type project resulting in 95 percent of the vehicles being recreational vehicles. It was a recreation-oriented road and I doubt that this road even carried 200,000 board timber feet. This indicates the flexibility of this particular road and trail economic analysis. You can analyze a variety of resources.

Regarding trucks on grades, we have found that trucks can usually travel the roads faster than other vehicles can. I don't know if that is due to the ability of the drivers or what, but they are driving these roads at least as fast as you can drive them in a passenger vehicle. They also have pretty healthy horsepowers and the gear ratios are fantastic, too. We have some logging roads that have up to 16 percent grades, for example, in Oregon. Of course, the trucks used have very low gear ratios. This results in a very low speed maximum.

Most of the roads we are building are nearly 100 percent logging roads and therefore, are built for trucks.

MR. LLOYD C. HALVORSON (Cooperative State Research Service): I thought Mr. Weller had a very interesting presentation but I am wondering if he could translate a little bit of that analysis to farm roads. In other words, for a farm road, which variables would you take into account in deciding whether it will pay to invest $1,000 or $10,000 in it?

MR. WELLER: That is a good point. In the land use planning process a timber crop is considered no different than a wheat crop. It just has a longer growing season, like maybe 80 to 120 years or more as compared to a few months for wheat, but the analysis is exactly the same.

MR. HALVORSON: It would seem to me that you don't have quite the same factors, like erosion and recreation. I would, however, agree that the basic analytical format is the same but it seems that you are plugging in somewhat different variables.

MR. WELLER: Well, yes, in all cases you apply that which is applicable.

MR. HALVORSON: But I am wondering whether you have thought about which road factors are more applicable in the analysis of rural roads. This is the question.

MR. WELLER: It's unfortunate that the National Association of County Engineers are not also represented here, because they probably do more of the work on roads directly serving farms than anybody else. I still think analysis is very much the same for forest and farm roads even though the trucks used are different in size, round trip travel times might be different, and haul costs might be different because of the dollar value per hour that is put on it. The variables, at least, are the same. The dollar values put into those variables may be a little different, like the cost of maintenance attributed to a wheat hauling truck may be different than that attributed to a logging truck because of the weight of the vehicle.

I obviously haven't answered your question in full.

MR. JOHN H. PENTECOST (Rural Development Service, Department of Agriculture): Regarding state rail plans, how can these plans be evaluated or reviewed in the absence of a national transportation policy?

MS. BLOOM: The law under which federal funds are provided to the states require the development of a state rail plan as a part of the overall transportation planning process. Our regulations do not specify the components of a state rail plan to the extent that a state has to have a certain number of projects for subsidy or other specifics, but they do encourage a planning process in which the type of analytical techniques that must be performed are fixed, and they require that public participation has to be sought.

When we receive a rail plan, we check first to see that the plan includes the lines which are legally eligible for assistance. Then we check to see that the process—the analytical planning activities—have been performed and that the public has been involved. Each state develops its own rail plan. There is no overall plan for the various states and the plans that we have reviewed in the Northeast vary greatly. Some states have a strategy of maintaining all branch lines. Other states drop a large number when they start and experiment on those that they subsidize to see which will prove profitable. There are as many strategies as there are states in the program and I don't think it would be beneficial to establish one pattern for all the states.

There are certain states that have performed the work from an analytical perspective better than others and we have made available the state rail plans that we judged to be the finest so that states that are just coming into the program can take a look at those and see what type of activity can be done. Indiana, for example, produced a very fine rail plan which was done by the university there and can be obtained by other states if they write the university, or if they want to look it over in our offices, they can.

MR. PENTECOST: If I may, the question relates to the interface between rail and road. That, I think, is where I have a great deal of concern. How is that linkage going to be made?

MS. BLOOM: There is the requirement during the development of a state rail plan that the state look at the substitution of alternate modes. This forces the state to look at rural road improvements in addition to the subsidization of a branch line or putting in an alternate rail service. States have done this. We have not received any projects for utilizing rail monies to improve roads. It is an eligible option but it has not been picked up by any of the states to date.

MR. RONALD F. REHL (CONRAIL): This is for Ms. Bloom. I realize you have all gradations of planning expertise in these states from good to bad to worse, but for those states which do not have a particularly effective rail program, can a group of shippers come in the second year when the Federal subsidy drops from 100 percent to 90 percent on a particular LDL line and pick up the subsidy where the state cannot or will not? As I understand it, however, the subsidy must still be administered through the state.

MS. BLOOM: That's right. The state can get its 10 percent share next year from shippers, from localities, from any place it wants. The program is a state program. The state has to come to us and apply for the project, but it is up to them where they get the money or the contribution in-kind. The law does not limit it to cash any more. The state can get the contribution in-kind from sources other than its own funds.

**Clyde Weller learns how to use TRISNET in planning Forest Service roads**

# Session E: Impacts on Rural Transportation from Changes in the Energy Situation and Transportation Policies

Dr. Stanley K. Seaver, *Moderator*
Professor of Agricultural Economics
University of Connecticut

## OVERVIEW OF SESSION

I want to compliment the one or two people—that's usually what it is—that decided to have this meeting, because I think it is the first one of its kind. Transportation is one of the most ignored subjects in the whole United States. We in the Land Grant colleges by and large have ignored it. There are only about three State stations in the whole Northeast that are doing anything on agricultural and rural transportation, and they are not dealing with the total transportation system.

There are imminent changes in the energy situation that will affect the economics and social acceptability of our transportation patterns and modes. Private automobiles, airplanes, and trucks are relatively dependent on petroleum, as well as being somewhat less efficient in energy use than are competing modes. Thus, other things being equal, these modes can be expected to be affected adversely by probable changes in the prices and price relationships of alternative fuels. The groups committed to using these disadvantaged modes may bear the larger share of the costs generated by changes in the energy situation over the next several decades. Some of our papers this morning address these issues.

Transportation policies are numerous and diverse, and changes in these policies differentially affect the various modes and user groups also. Among the more important proposed policies is that of shifting the costs of waterway development, maintenance and operation from general taxpayers to waterway users, and one of our papers is concerned with the impacts expected to accrue if this proposal is adopted. Other papers are devoted to the broader policy issues involved in the provision of rural transportation services.

# Trends in National Rural Transportation Policy

Robert H. Bruton
Acting Director, Office of Rural Transportation Policy
U.S. Department of Transportation

I would like in this presentation to briefly review the status and evolution of existing Federal policies affecting light density transportation in rural areas and to suggest some areas where changes might occur. To begin with, it appears to me that most existing policy in this area is based on one basic premise. The premise is that most light density transportation, by its very nature, cannot be financially self-supporting.

Based on this premise, public policy has often been designed to protect rural communities and businesses from the natural operation of market forces in the transportation industry and from the apparently insatiable demand for public funds of larger metropolitan areas. It has been claimed and widely accepted that rural areas receive more than their equitable share of Federal highway user taxes; that rural freight rates are artificially depressed; that passenger services to rural areas require and receive subsidies; and that much existing transportation ser-

vice provided by privately owned carriers would be discontinued if those carriers were not forced by public regulation to provide service.

The origin of the premise that light density transportation is intrinsically unprofitable probably arises from the economics of rail transportation. Rail transportation is by the very nature of the technology ill-suited to light density service. During the period that railroads dominated the national transportation system, rural areas demanded and eventually received public protection from discrimination by the railroad industry which would presumably otherwise have concentrated service in high density markets.

However, other modes of transportation have been developed—the airplane, the bus, the automobile, the truck—which do not seem to be particularly more efficient in high density markets. In fact, there does not appear to be any economies of scale and in some cases because of congestion these modes of transportation appear to be more efficient in light density markets. One example is congestion at airports, in particular the airports around New York where congestion is simply forcing the use of alternative modes of passenger transportation. The other example is the movement of shippers from central cities to suburbs because of the highway congestion in cities and the inability to get adequate motor carrier service into city centers.

We also at the same time have examples of these modes providing very effective and profitable light density service. We have presently a rapidly growing and profitable commuter air carrier industry providing light density service. There are many small intercity bus operations which specialize in rural service and are surprisingly profitable businesses. We have examples of trucking firms which specialize in rural service which again appear to be efficient and profitable. Lastly, we most recently have had some rural public transportation operations which, while not profitable, are at least much more efficient in terms of cost per passenger mile or cost per vehicle mile than are their urban counterparts.

Given this evidence, I think it is important to ask why public policy appears still to be based on the premise that light density transportation is intrinsically unprofitable and that rural areas served require some form of public protection. One explanation, of course, is simply historical lag. It takes some time for public institutions to recognize and accommodate to change.

Another possibly more significant explanation is that many rural communities and businesses have grown around and adapted themselves to long established public policies. Probably the best known example are those businesses and communities which have become dependent on uneconomical rail branch line service. Even though truck service in most of these cases would be more efficient, these businesses and communities often face uncertainty and hardship in shifting to new modes. Dealing fairly and equitably with these communities and businesses will be a major challenge if policy changes are to be accomplished.

Once having recognized the need to reevaluate the basic premise upon which policy is based, two general areas of policy change appear appropriate. The first area where policy change should be examined is in public regulation.

While one objective of public regulation has been to protect rural shippers and receivers, it may also have worked to create transportation industries which are ill-suited to providing rural service. Particularly through control of entry, public regulation may have led to the formation of large carriers which concentrate on high density markets and in the process become inefficient at and uninterested in light density service. As a matter of primary importance in the area of public regulation, some mechanism needs to be developed which will allow and even encourage the development and exploitation of carriers which specialize in light density service.

Such carriers are already in existence and are increasingly being exploited. Basic reform of public regulation is under investigation but may prove unnecessary at least from the standpoint of rural service. Some less sweeping changes might very likely be helpful, however.

The second area where change appears appropriate is in public investment policy. For quite some time public investments in transportation and particularly Federal investments have concentrated on major facilities to accommodate high density demands. These investments for the most part have been clearly justified. However, it is worth noting that much of this investment has been in facilities to accommodate modes of transportation which are particularly well suited to low density markets. Further, as a result of the general effort to improve facilities for high density markets, we may have neglected facilities required for light density markets.

In this area, highway investment appears to be the most relevant example. The private automobile and motor carrier service appear to be ideally suited to lower density rural service. When compared with rail service, which is well suited to higher density service, this potential benefit to rural areas becomes even more obvious. Yet public highway investment policy continues to place highest priority on serving high density markets. Thus, some reallocation of public resources for highway improvement appears worth serious consideration.

As with much public policy analysis, the apparent directions which policy should move are often simpler to determine than implementing policy in the real world. Such clearly is the case with rural transportation policy. Even if there could be some loosening of regulatory barriers and some redirection of public investments toward light density facilities, there are a number of problems which might greatly reduce potential benefits.

One such problem is the one previously mentioned of dealing fairly and equitably with those who may have hardships imposed upon them by policy change. Another, which is important if public funds are applied to smaller light density facilities, is the complex red tape that goes along with using Federal assistance. In some cases, meeting Federal requirements is so complex, time consuming and costly that a project is not worth the effort.

Possibly, the most significant problem and one which often escapes the attention of those who are unfamiliar with rural transportation is the ingenuity required effectively to plan and implement a small facility improvement or to start up a small rural transportation enterprise. Manpower is in short supply and complex decisions, often involving more than one mode and often crossing over the normal distinctions between planning, implementation and operation, must be made by a single individual.

The skill and ingenuity of rural people are often impressive—I am thinking particularly of the county engineers and the managers of certain rural transit projects—but some form of outside technical and planning assistance would be very useful. In this regard, the Department of Transportation might gain some important insights from the agricultural extension service.

This brings me to one last point which is most relevant to this conference, viz., what type of research is most needed in developing rural transportation policy. While I realize that this may not be widely accepted, I believe the general directions in which policy will move is relatively well analyzed and understood. What we need most at this time is very practical research to better understand how to implement policy and what the side effects of policy change might be. In this regard, we need to better understand existing small-scale rural transportation planning, operations and management along with how they might be affected by changes in policy. This is therefore an appeal for more short-term practical research, not necessarily as a substitute for, but more as a complement to, more abstract longer range research.

# Impact of Waterway User Charges on Grain and Fertilizer Shipments: A Simulated Case Study

Arvin R. Bunker
Agricultural Economist, Economic Research Service
U.S. Department of Agriculture

In the last Congress, legislation was introduced and considered which would require waterway users to pay all or part of the expenditures for operation and maintenance of the inland navigable waterways and for the development costs of these waterways. Similar legislation is expected to be introduced early in the next session of Congress. A study by the Economic Research Service and the University of Illinois measured the expected short run changes in the marketing and transportation of grain and fertilizer for a county in central Illinois in response to selected levels of waterway user charges (4). The grain and fertilizer marketing and transportation practices for calendar year 1973 and capabilities as of January 1, 1975, were determined by survey and were then simulated by a linear programming (least cost) model to establish the "basic solution" without waterway user charges. User charges were then imposed on all water shipments and changes in the total cost of marketing and transportation of grain and fertilizer, in the utilization of each mode of transport, in spatial distribution patterns, in road and highway use, in revenue generated, and in several other variables were measured as the user charges were increased.

## THE COUNTY SELECTED FOR DETAILED STUDY

Logan County, Illinois, is located in central Illinois between 25 and 65 miles from the Illinois River barge loading points (Figure 1). The County is predominantly rural in character and has over 95 percent of its land in farms, of which 93 percent is utilized in the production of corn and soybeans with average yields in 1973 of 122 and 39 bushels per acre, respectively. In 1973, livestock production accounted for only 14 percent of all farm receipts. The large grain production and small livestock consumption of grain resulted in approximately 35,000

**Figure 1. Geographical location of Logan County, Illinois, with selected destinations for grain and origins for fertilizer products**

bushels per square mile requiring transport out of the County. Major destinations for grain moving out of the County and for fertilizer products moving into the County for calendar year 1973 are given in Table 1. The mathematical model required approximately similar marketing patterns. Cost of transportation and cost of operation of grain and fertilizer facilities were obtained from secondary sources (3 and others).

## RESULTS

The results of the basic solution confirmed the importance of barge transportation to the movement of grain and fertilizer for Logan County. All grain shipments to the Louisiana Gulf, which were 64 percent of grain shipments, were by truck-barge. Truck-barge shipments of fertilizer accounted for 22 percent of dry fertilizer shipments and 13 percent of anhydrous ammonia shipments. There were no truck-barge shipments of liquid fertilizer other than anhydrous ammonia. For all products, barges accounted for 88 percent of the total ton miles of products transported.

Waterway user charges were imposed in five increments of .05 cents per ton mile. For the 1,150 mile journey from the Illinois River loading points to the Gulf, the total additional charge per increment would be 57.5 cents per ton. These charges were added to a transport rate of $3.67 per ton for grain, $7.15 per ton for dry fertilizer and $11.50 per ton for anhydrous ammonia.

The revenue yield from user charges was maximized at the charge level of 0.1 cents per ton mile (Table 2). At the charge level of 0.25 cents per ton mile, no grain or fertilizer was shipped by barge. The marketing and transportation bill was increased 2 percent by the charge increment of 0.05 cents; 5 percent by the 0.1 increment; and 6 percent by all of the higher increases. This bill included the full cost of transportation services by carriers, the full cost of highway maintenance attributable to grain and fertilizer traffic, the variable cost for use of existing grain and fertilizer marketing facilities, and the full cost for the use of required new facilities, if any.

At the 0.05 charge level, anhydrous ammonia was the only commodity that changed the quantity of shipments by barge. Barge shipments of grain and dry fertilizer did not change. At the charge level of 0.1 cents per ton mile, all barge shipments of anhydrous ammonia were terminated, and grain shipments decreased by 29 percent. Dry fertilizer shipments, however, were not changed from the basic solution. The largest marginal decline in total traffic occurred when the user charge level increased from 0.1 to 0.15 cents per ton mile. Grain accounted for most of the decrease, but barge traffic of dry fertilizer also decreased. At the user charge level of 0.25 cents per ton mile, no grain or fertilizer was shipped by barge.

The total ton miles of traffic by all modes decreased as the user charge increased (Table 3). This decrease is principally a result of the more direct route of rail lines to the Louisiana Gulf (approximately 750 miles) than are the Illinois and Mississippi Rivers (approximately 1,150 miles plus truck shipment).[1] As was expected, the modal share of truck and of barge traffic declined as the user charge increased. The first incremental charge of 0.05 cents had little impact on either the total ton miles of traffic or the modal shares. The next four increases in user charges, however, caused substantial decreases in the ton miles of truck and barge traffic and substantial gains in the ton miles of rail traffic. The modal shares of barge and rail traffic also changed substantially.

The modal shares of truck transportation did not change as much as the modal shares of rail and barge transportation. This results from the farm to elevator and fertilizer distributor to farm delivery function that trucks perform regardless of the long haul transport mode selected. As barge transportation decreased, the associated "long haul" trucking to the Illinois River decreased but the local collection and delivery functions continued. The changing utilization of long haul versus local trucks can be seen in looking at the utilization of the several highway types (Table 4). Roads outside Logan County accommodated the long haul truck traffic. For roads within Logan County, the interstate or divided highways and the primary Federal and State marked routes derived most of their utilization from long haul truck transport. The other three road types, i.e., secondary roads, gravel surfaced roads, and soil surfaced

Table 1. Quantity, origin or destination, market share and transport mode share of shipments of grain and fertilizer for Logan County, calendar year, 1973

| Product or product group | Average shipments per firm | Major origins or destinations[1] | Market share | Transport mode share[2] | |
|---|---|---|---|---|---|
| | | | | Truck | Rail |
| | Tons | | | Percent | |
| Grains | 28,100 | Havana, Illinois | 52 | 99 | 1 |
| | | Decatur, Illinois | 29 | 70 | 30 |
| | | Gulf States | 8 | 1 | 99 |
| | | Peoria, Illinois | 5 | 86 | 15 |
| | | Southeastern States | 4 | 0 | 100 |
| | | Other destinations | 3 | 87 | 13 |
| | | All destinations | 100 | 78 | 22 |
| Anhydrous ammonia | 691 | Peoria, Illinois | 42 | 93 | 7 |
| | | St. Louis, Missouri | 16 | 95 | 5 |
| | | Ft. Madison, Iowa | 15 | 87 | 13 |
| | | Tuscola, Illinois | 10 | 66 | 34 |
| | | Other origins | 18 | 69 | 31 |
| | | All origins | 100 | 86 | 14 |
| Liquid nitrogen and liquid mixed solution | 781 | Meridosia, Illinois | 34 | 100 | 0 |
| | | Springfield, Illinois | 22 | 100 | 0 |
| | | St. Louis, Missouri | 15 | 100 | 0 |
| | | Other origins | 30 | 96 | 4 |
| | | All origins | 100 | 99 | 1 |
| Phosphates (principally diammonium and triple super phosphate) | 906 | Florida | 81 | 5 | 95 |
| | | Ft. Madison, Iowa | 7 | 0 | 100 |
| | | Other origins | 13 | 59 | 41 |
| | | All origins | 100 | 12 | 88 |
| Potash | 1,109 | Canada | 88 | 2 | 98 |
| | | New Mexico | 9 | 0 | 100 |
| | | Other origins | 3 | 18 | 82 |
| | | All origins | 100 | 4 | 96 |
| Registered commercial grades (including urea and ammonium nitrate) | 197 | Ft. Madison, Iowa | 36 | 42 | 58 |
| | | St. Louis, Missouri | 28 | 100 | 0 |
| | | Streator, Illinois | 16 | 100 | 0 |
| | | Peoria, Illinois | 15 | 75 | 25 |
| | | Other origins | 6 | 100 | 0 |
| | | All origins | 100 | 75 | 25 |

[1]Names for major origins represent areas rather than specific cities. For example, shipments listed as originating in St. Louis, Missouri, may actually have originated in East St. Louis, Illinois.
[2]Transport mode as shipment departed or arrived the Logan County Facility.

roads, accommodated primarily the local collection and distribution function of trucks. As the user charge level increased, the primary intercity highways experienced substantial declines in traffic while the local collector roads experienced only minor decreases and, in some cases, increases in traffic.

The waterway user charge caused several changes in the marketing patterns of grain elevators. As the waterway user charge increased, the truck-barge shipments that many elevators participated in were replaced by rail shipments through those few elevators which enjoyed multicar shipping rates. In the basic solution, 17 elevators participated in shipments (all by truck-barge) to the Louisiana Gulf while with waterway user charges of .2 cents per ton

Table 2. Revenue yield, marketing and transportation bill and annual utilization of waterway in response to selected levels of waterway user charges on Logan County grain and fertilizer shipments

| User charge level | Revenue yield | Marketing and transportation bill | | Annual utilization of waterway | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | All products | | Grains | | Dry fertilizer | | Anhydrous ammonia | |
| | | Total | Chg. from basic solution | Total | Chg. from basic solution | Total | Chg. from basic solution | Total | Chg. from basic solution | Total | Chg. from basic solution |
| Cents per ton mile | Thous. dol. | Thous. dol. | Pct. | Tons. | Pct. | Tons | Pct. | Tons | Pct. | Tons | Pct. |
| [1]0.0 | 0 | 9,511 | – | 409,075 | – | 396,814 | – | 10,949 | – | 1,312 | – |
| 0.05 | 235 | 9,746 | +2 | 408,044 | –[2] | 396,814 | 0 | 10,949 | 0 | 281 | -79 |
| 0.1 | 336 | 9,944 | +5 | 291,868 | -29 | 280,919 | -29 | 10,949 | 0 | 0 | -100 |
| 0.15 | 242 | 10,076 | +6 | 139,755 | -66 | 131,300 | -67 | 8,455 | -23 | 0 | -100 |
| 0.2 | 56 | 10,116 | +6 | 24,466 | -94 | 23,357 | -94 | 1,108 | -90 | 0 | -100 |
| 0.25 | 0 | 10,118 | +6 | 0 | -100 | 0 | -100 | 0 | -100 | 0 | -100 |

[1]Basic solution.
[2]Less than 0.5 percent.

mile, only eight elevators participated in shipments (mostly by rail) to the Gulf. Those grain elevators that enjoyed multicar rates did not rely on nearby country elevators for their grain supply but rather acquired their grain directly from farmers. If the multicar loading point had insufficient storage space, the grain was most often stored on farms and transferred direct to the multicar loading point rather than stored temporarily in nearby country elevators. There were no transfers of grain among elevators within Logan County.

## CONCLUSIONS

Anhydrous ammonia appeared to be the commodity most sensitive to increases in barge transport costs. Dry fertilizer shipments appeared to be least sensitive to increases in waterway user charges. Grain appeared to be slightly more sensitive than dry fertilizer. Solutions in which the truck-barge mode of grain transport was dominant allowed more elevators to participate in grain shipments to the

Table 3. Total ton-miles and modal share of traffic at selected levels of waterway user charges for Logan County grain and fertilizer shipments

| User charge level | Ton miles of all modes | Change from basic solution | Modal share of traffic | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Truck | | | Rail | | | Water | | |
| | | | Total traffic | Chg. from basic solution | Modal share | Total traffic | Chg. from basic solution | Modal share | Total traffic | Chg. from basic solution | Modal share |
| Cents per ton mile | Mil. ton miles | Pct. | Mil. ton miles | –Percent– | | Mil. ton miles | –Percent– | | Mil. ton miles | –Percent– | |
| [1]0.0 | 536.3 | – | 20.0 | – | 4 | 45.4 | – | 8 | 470.9 | – | 88 |
| 0.05 | 535.9 | 0 | 20.0 | 0 | 4 | 46.3 | +2 | 9 | 469.7 | 0 | 88 |
| 0.1 | 489.4 | -9 | 14.3 | -29 | 3 | 139.1 | +206 | 28 | 336.0 | -29 | 69 |
| 0.15 | 428.5 | -20 | 8.4 | -58 | 2 | 259.1 | +470 | 60 | 161.0 | -66 | 38 |
| 0.2 | 378.8 | -29 | 4.8 | -76 | 1 | 345.8 | +661 | 91 | 28.2 | -94 | 7 |
| 0.25 | 369.0 | -31 | 4.1 | -80 | 1 | 364.9 | +703 | 99 | 0 | -100 | 0 |

[1]Basic solution.

Table 4. Highway utilization by road type at selected levels of waterway user charges for Logan County grain and fertilizer shipments

| User charge level | Utilization outside Logan County | Utilization inside Logan County[1] | | | | | |
|---|---|---|---|---|---|---|---|
| | | All roads | Interstate or divided highway | Primary Federal and State marked routes | Secondary roads bituminous surface | Gravel or stone surfaced | Soil surfaced |
| Cents per ton mile | | | | Thousand ton-miles | | | |
| [2]0.0 | 10,525 | 9,490 | 366 | 6,404 | 1,131 | 1,356 | 233 |
| 0.05 | 10,505 | 9,489 | 367 | 6,403 | 1,130 | 1,356 | 233 |
| Chg. from basic (percent) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.1 | 8,098 | 6,207 | 321 | 3,255 | 1,029 | 1,362 | 239 |
| Chg. from basic (percent) | -23 | -35 | -12 | -49 | -9 | 0 | +3 |
| 0.15 | 4,376 | 3,992 | 162 | 1,179 | 1,102 | 1,401 | 239 |
| Chg. from basic (percent) | -58 | -58 | -56 | -82 | -11 | +3 | +3 |
| 0.2 | 1,381 | 3,421 | 161 | 541 | 1,031 | 1,456 | 232 |
| Chg. from basic (percent) | -87 | -64 | -56 | -92 | -9 | +7 | 0 |
| 0.25 | 605 | 3,461 | 160 | 561 | 1,041 | 1,468 | 230 |
| Chg. from basic (percent) | -94 | -64 | -56 | -91 | -8 | +8 | -1 |

[1]Miles of each road type in Logan County in order from left to right are: 26, 94, 298, 574, and 195.
[2]Basic solution.

Gulf than did those solutions in which railroads dominated shipments to the Gulf.

The increase in the total marketing and transportation bill was not large in percentage terms in view of the substantial shift in marketing and transportation patterns that occurred. At current rail rates (spring 1975), unit trains provided a competitive alternative to transport of grain by barge. The decreased truck-barge transport was evident in the sharply decreased utilization of intercity highways. The utilization of local roads for the collection and distribution of grain and fertilizer, however, experienced only minor changes.

## Public Policy Decisions on Waterway User Charges

In the U.S., waterway characteristics vary considerably and the amount and type of traffic also vary considerably. Of 14 major rivers in the U.S., average per-ton-mile expenditures for operation and maintenance averaged .05 cents per ton mile but varied from a low of .02 cents per-ton-mile on the Mississippi River to 3.28 cents per-ton-mile on the Apalachicola, Chattahoochee, and Flint Rivers (Table 5). The Missouri, Arkansas, and Kentucky Rivers all had operation and maintenance expenditures in excess of 1 cent per ton mile. It is clear that if each specific waterway segment were required to recover through waterway user charges its own costs of operation and maintenance rather than system average costs, some river segments would experience significantly greater charge levels than other river segments.

Several types of user charges have been proposed including segment tolls, lockage fees, per-ton-mile or per-ton taxes, fuel taxes, license fees, and others (5). Regardless of the public policy selections regarding user charges, they will either explicitly or implicitly choose policies that will impact different waterways in different ways. Some of the policy decisions that appear yet to be made include first, of course, whether the present policy of no charge should be continued. If user charges are to be imposed then the

Table 5. Average annual costs of operation and maintenance of selected inland waterway segments with ton miles of traffic, 1973, length of waterway and number of locks

| River or river segment[1] | Yearly average cost of operation and maintenance[2] | Total annual traffic 1973[3] | Cost per ton mile[4] | Total length of waterway[5] | Number of locks[5] |
|---|---|---|---|---|---|
| | 1,000 dollars | Mil. ton miles | Dollars | Miles | Number |
| Mississippi (upper and lower) | 22,800 | 91,479 | .0002 | 2,360 | [6]30 |
| Ohio | 10,700 | 29,925 | .0004 | 981 | [7]43 |
| Illinois[8] | 3,600 | 8,586 | .0004 | 354 | 7 |
| Missouri | 11,500 | 884 | .0130 | 732 | 0 |
| McClellan-Kerr Arkansas | 5,300 | 339 | .0157 | 448 | 17 |
| Allegheny[9] | 800 | 83 | .0096 | 72 | 9 |
| Monongahela | 1,900 | 1,495 | .0013 | 129 | 11 |
| Kanawha | 981 | 796 | .0012 | 91 | 3 |
| Green and Barren | 569 | 1,396 | .0004 | 180 | 5 |
| Cumberland | 3,160 | 1,055 | .0030 | 317 | 3 |
| Tennessee | 8,000 | 3,928 | .0020 | 652 | 10 |
| Black Warrior, Warrior, Tombigbee | 2,537 | 3,729 | .0007 | 466 | 6 |
| Apalachicola, Chattahoochee, Flint | 4,079 | 124 | .0328 | 297 | 3 |
| Kentucky | 873 | 52 | .0167 | 259 | 14 |
| All rivers | 76,799 | 143,871 | .0005 | 7,338 | 161 |

[1]Including only rivers or river segments without ocean going traffic.
[2]Five year average. Source: Reference item 1.
[3]Source: Reference item 2.
[4]Computed by dividing yearly average cost of operation and maintenance by total annual traffic, 1973.
[5]Source: Reference item 1.
[6]Of the 30 locks and dams, 27 are located on the upper river, above the confluence of the Missouri River.
[7]To be replaced by 19 locks and dams.
[8]Including Calumet-Sag Channel.
[9]Improved portion only, from below East Brady, Pennyslvania.

decisions on the type of charges to be adopted perhaps will raise the following issues:

1. What portion of the public expenditure should be recovered:
   a. Operation and maintenance costs or capital costs or both?
   b. Total expenditures or those expenditures identified as related to commercial navigation?
2. Should the user charge recover current, past, or expected future expenditures and over what period should the expenditures be computed and in what year should they be recovered?
3. Should different river segments be assessed different charges or should system-wide averages only be considered? If user charges are to be determined on a river or subsystem basis, should we classify rivers by regions, by principal commodities, by river characteristics, or by some other factors?
4. Upon which group of people, i.e., producers or manufacturers, shippers, carriers, consumers or taxpayers should the incidence of the user charge fall?

Agriculture and many rural areas have an interest in the resolution of the waterway user charge issue. Depending on the specific policy decisions made, some regions or some producers of agricultural inputs and outputs will experience changes in their economic positions.

## FOOTNOTE

[1]The greater circuity of barge (1,150 plus miles) over rail (750 miles) to the Louisiana Gulf has some implication for fuel consumption. Even though barge transport is more fuel efficient on a ton mile basis, the greater mileage of barge shipments may result in greater per-ton fuel consumption by barge than by rail.

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# The Role of Highways in the Transportation of Domestic Energy Resources


John T. Berg
Economist, Federal Highway Administration
U.S. Department of Transportation


The 1973–74 oil embargo by the OPEC nations seems a long way from the area of concern of a conference on rural transportation. Yet, as we are all aware, there is little that has not been affected by that so-called "energy crisis." Of particular importance to rural areas and rural transportation systems has been the increased attention given to the development of domestic energy sources as an insulation against problems created by our dependence on foreign oil.

Coal, in particular, is being viewed as a major source of future energy production. The rate of coal production, which is currently at a level of about 600 million tons per year is expected to rise to around one billion tons per year by 1985. This amounts to a doubling of the average annual increase in production that took place over the 1960 to 1974 period. While there may be considerable uncertainty about the reliability of forecasts of future production, particularly in the energy area, there does appear to be a consensus that coal will play a major role in our Nation's energy future.

Although increased use of coal and other domestic sources of energy is expected to be of substantial benefit to the Nation, many States and localities where these materials are currently being produced or will be produced in the future are concerned about the sometimes substantial social and economic costs that can go along with increased production and transportation of energy resources. One need only look to the Appalachian States to see that the externalities generated by natural resource production can have a number of adverse impacts on the residents of affected areas. Such externalities have particularly important implications for residents of rural areas, where natural resource production has its initial impact, and for rural transportation systems, over which the inputs and outputs of energy industries must be carried.

Several States are particularly concerned about the problems presented by the use of highways for the hauling of coal. In response to this concern, the Congress, in Section 153 of the Federal-Aid Highway Act of 1976, directed the Secretary of Transportation to make a one-year investigation and study "for the purpose of determining the need for special Federal assistance in the construction or reconstruction of highways on the Federal-aid system necessary for the transportation of coal or other uses in order to promote the solution of the Nation's energy problems." Responsibility for conducting this study has been delegated to the Federal Highway Administration and I would like to spend a few moments reviewing our study efforts and discussing some of the issues that a study of this nature must address.

Our first task was to define the scope of the study in such a way that it would answer the questions of concern to Congress and yet still be a manageable one-year undertaking. It was clear from preliminary investigations, as well as from congressional discussions, that while the emphasis of the study should be on coal and its impacts, the impacts of developing other domestic energy resources, such as uranium or petroleum were equally important to some States and should receive some attention in the study.

It was also decided that the study would not be complete if it were limited to highways on the Federal-aid system. Reports from several States, including Kentucky, Montana, North Dakota and

Tennessee, indicate that a considerable part of the resource hauling impacts are on local roads.

Finally, it was decided that, since energy forecasts beyond 1985 were highly uncertain, particularly at a disaggregated level, the study would be limited to the period through 1985. This is not to discount either the importance of highway problems that might be created by energy resource development after 1985 or the possible need for further study of these problems, but rather to concentrate the study on more immediate concerns.

The Section 153 study will encompass a number of areas of research, each designed to lead to a recommended solution to the types of highway problems created by expanded production and conversion of domestic energy resources. Because of the degree of uncertainty about the future role to be played by each of the major energy resources, the first part of the research effort consists of an evaluation of alternative national and regional energy forecasts. We have employed a consulting firm with a considerable amount of experience in this area to carry out the required analysis. Forecasts will be analyzed in terms of their sensitivity to assumptions concerning conservation methods, environmental constraints, energy prices, and other factors. The output of this effort should provide a much better understanding of the future prospects for the location and extent of development of each of the major energy resources.

The second study component will identify and analyze transportation requirements related to energy activities. Of concern in this part of the study will be both the requirements for moving energy resources and the other transportation demands generated by construction activities, employment and population growth due to production and conversion of energy resources. We are conducting parts of this research ourselves and have employed a transportation consultant to look in more detail at the requirements for transporting coal. This effort will identify the present use of modes for coal hauling, describe the reasons for the choice of mode in each of the major coal producing and consuming regions and analyze the modal efficiency for coal hauling through 1985. In each of these areas the primary emphasis will be on analyzing situations where trucks might reasonably be considered to be a major coal haul competitor.

When viewed from a national perspective, trucks are clearly not a major part of the coal transportation network. Data published by the Bureau of Mines indicate that only about 12 percent of coal production is shipped the entire distance from producer to consumer by truck. On a ton-mile basis, trucks are an even smaller part of the coal transportation system. A 1973 study by Jack Faucett Associates found that only about 3 percent of coal ton-miles were shipped by truck (5).

Yet, in some areas and under some sets of conditions, trucks are an important means of moving coal. The output of small mining operations in some Eastern States is often moved by truck since annual tonnages cannot efficiently utilize dedicated equipment such as unit trains or barges and because railroad facilities are not available. Trucks are also quite important in areas where total shipment distance is relatively short, such as from a mine to a nearby powerplant, or in areas where strip mine operations require the flexibility provided by trucking. These truck movements are typically over short distances to a transshipment point but in some cases trips of 200 miles or more have been recorded.

In many Western States the highway problems created by expanded use of domestic energy resources result not so much from the hauling of the resource as from the traffic demands created during the construction and operations phases of new or expanded energy facilities. Our research is also attempting to quantify these impacts.

A third major study input consists of a survey of the States to identify highway needs related to energy resource production and conversion. Each State is being asked to estimate additional highway costs based on forecast levels of energy related activities. Information collected in earlier phases of the study will be used to analyze these estimates.

The remaining parts of the study will analyze alternative solutions to any highway problems that might be defined in earlier parts of the study. First, the possibilities for substituting nonhighway modes for trucks will be examined in some detail. The possibility of reducing highway impacts by consolidating coal transshipment facilities will also be looked into. Another section of the study will examine the financial ability of the States to respond to these types of highway problems. In this regard we have been collecting data on State taxes and revenues and have asked the States to provide estimates of future revenues related to energy activities.

The final input to the Section 153 study will be an economic analysis of alternative revenue sources and jurisdictional responsibilities that might be used in reaching a solution to any highway problems created by coal hauling or other energy related activities.

To further illustrate some of the issues being investigated in this study I would like to draw on some information relating to the State of Kentucky. Kentucky because of its long experience with the coal industry, has probably done as much as any State in trying to define the coal haul problem.

Kentucky currently produces slightly more than one-fifth of the Nation's coal output. Coal production in 1975, 144 million tons, was more than double the 61 million tons produced in 1961. Nearly 4 million tons per year have been added to Kentucky's coal output since 1970. Most of this increase has been low sulfur coal from surface mines in Eastern Kentucky.

Trucks are an important part of the coal transportation system in Kentucky. In 1975 nearly 77 percent

of Eastern Kentucky's coal moved from the mine on a truck (4). Most of these loads move relatively short distances from the mine to a rail or barge loading point. Data from 1973 show that only about 8 percent of Eastern Kentucky's production moved to its final destination by truck (3).

The widespread use of coal trucks in Eastern Kentucky results in part from the nature of coal mining operations. The industry is characterized by a large number of small mines which are often operated for limited periods of time. Short lead times for bringing small surface mines into operation, an abundance of substitutable construction equipment and flexible entry conditions have made surface mining the principle supply respondent to recent increases in the spot market price of coal.

Large trucks are of particular importance in Eastern Kentucky. A study conducted by the University of Kentucky in 1971 found that, of the strip mines reporting from each region in Appalachia, "trucks used in Kentucky are by far the largest, nearly twice as large in capacity as the average truck used in Pennsylvania and half again as large in capacity as those used in West Virginia" (2, p. 68). The same study found that a significant number of coal trucks exceeded the legal load limits. A number of three axle trucks were found to have a weight of 48,000 to 60,000 pounds on the tandem axles. The legal load limit at the time of the study was 32,000 pounds. Data supplied in a study by the Kentucky Department of Transportation indicate that, in 1974, about two-thirds of coal loads on each of Kentucky's three higher classes of highways exceeded the legal limits.

It is difficult to estimate precisely the impact of these overloads on highway costs but it is instructive to note the effect of various loads on a pavement design typical of what would be used on the Federal-aid primary system. For example, if the load on a tandem axle set is increased from 32,000 pounds to 36,000 pounds, the effect on the pavement, in terms of equivalent axle loadings, is increased by 60 percent. Increasing the load from 32,000 pounds to 40,000 pounds increases equivalent axle loadings by 142 percent. And, if the tandem axle load is increased from 32,000 to 48,000 pounds, the effect on the pavement is increased by 385 percent, based on (1). These examples give some indication of the increasing pavement deterioration under increasingly heavy loads. The destructive effects of overweight vehicles on bridge structures is, of course, also of major importance.

Stricter enforcement of truck weight limits should reduce annual highway costs and prove to be in the best interest of State residents. The University of Kentucky report mentioned above concludes that "weight limitations can be enforced without inflicting hardships upon the economy of the region and with a net increase citizens' welfare . . . . Enforcing weight limitations would shift forward, in the form of higher prices to coal buyers, the social cost now borne by Kentuckians. This would result in a general increase in real income in the State because resources now devoted to the repair and maintenance of damaged roads would be freed for other more useful purposes" (2, p. 7).

Although there are a number of factors that must be considered in arriving at a solution to the types of coal-related highway problems found in Kentucky and other States, it is clear from the standpoint of economic efficiency that any public program should minimize undesirable side effects on private decision making units. If the private market is affected, the economy should be moved toward making economic decisions on the basis of prices that reflect the relative scarcity of resources. To the extent that the price of a good does not cover the full costs of resources used up in bringing that good to the market (including transportation to the point of consumption) the payments of consumers do not cover the true social cost incurred as a result of their consumption. If highway costs are increased because the highways are being used by heavy coal trucks and if these costs are not reflected in the price of coal, then coal producers and/or coal truckers—and, ultimately, coal consumers—are paying only a portion of the costs which their activities generate. Part of the costs are shifted to those who must contribute through State tax dollars to maintenance of roads or who must accept the risks and discomforts of deteriorated roads. Since about 80 percent of Kentucky coal is shipped outside the State and part of that outside the United States, residents of Kentucky are to a large extent subsidizing coal consumers in other jurisdictions.

Whatever source of revenues is to be tapped, it seems clear that the least costly (most efficient) manner of financing an energy related highway improvement program is to tie program costs as directly as possible to program beneficiaries (this would also seem to be acceptable on equity grounds). Because the most direct beneficiaries of a coal road improvement program would be the users of the improved roads, this would seem to be a logical point to impose increased taxes. The largest share of the tax burden could fall on coal trucks (and particularly on heavier coal trucks). The increased costs could then be passed forward in the form of higher freight rates to eventually be borne by consumers of the coal transported over the improved highways.

I hope that this brief review has given some indication of the variety of complex issues that must be addressed in the Section 153 study. We plan to have a first draft report completed sometime in February 1977 and would certainly be interested in obtaining any studies or other information that any of you might be willing to provide.

Before closing I would like to mention another study that FHWA's Planning Office is now beginning to design. This study would, among other

things, investigate and develop data on the adequacy of rural local and collector roads in meeting present and future freight hauling needs. The present plans are to concentrate this effort on determining the adequacy of these roads in meeting the needs of moving agricultural supplies and products. The study would take an in-depth look at a small number of areas and would attempt to develop data to analyze the adequacy of local and collector roads, especially as they relate to rail line abandonments, increases in truck sizes and weights, accessibility to elevators, realignment of the Federal-aid secondary system, and seasonal fluctuations in road use.

Since we are just in the initial stages of reviewing existing studies to better define the research plan, we would be most interested in obtaining any types of studies or other information that might be useful in this effort. To provide such information or find out more about the study you could contact Walter Bottiny in our Office of Program and Policy Planning.

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# Impact of Transportation Energy Balance on Movements In and Out of an Agricultural Area


Kenneth A. Brewer[1]
Professor of Civil Engineering and Engineering
Research Institute, Iowa State University


The perspective taken herein is that of a state, or a major regional area within an agricultural state, with a major emphasis on commodity and goods movement. However, since the impact of transportation energy balance has a system interaction effect on person movements some consideration must be given to this area. Finally, the behavioral decision process which results in actions by individuals, households and businesses is examined from a theoretical standpoint as a key to future areas of research.

In order to discuss the impact of transportation energy balance on movements in and out of an agricultural area from the state perspective, the origin-destination pattern of these movements must be examined from a source-sink network concept. Data discussed and presented are generally based on those resulting from studies conducted within Iowa. However, such data can be generalized to other states of relatively high volumes of agricultural production, relatively stable population (total), and a relatively stable or slowly changing quality of transportation system.

"Transportation energy balance" needs to be defined. In our context, this descriptor will imply the relative availability of fuels among using modes regardless of whether the allocation mechanism is a supply-demand determined price, a tax determined price, a regulatory controlled price, a regulatory controlled allocation, or a combination of these mechanisms. The impacts are changes in transportation user's desire to select a particular mode, in the private transportation operator's desire to provide selected services at a particular price, and in the public sector planner-manager's interest in promoting a particular transportation policy (with an associated plan and implementation program). It is also necessary to retain a perspective which recognizes that factors other than transportation energy availability, cost, etc., are intervening in travel and transport decisions, and that these other factors may be more salient to the ultimate decision-maker than energy factors.

## COMMODITY AND GOODS MOVEMENT

Examination of commodity and goods movement provides three convenient categories with potentially different impacts associated with the availability of transportation energy: (1) movements as-

sociated with agricultural produce; (2) movements associated with agricultural consumption; (3) movements in and out of agricultural areas neither produced nor consumed in agriculture. There is a potentially different source-sink network for each category. As the degree of concentration and dispersion changes within the movement from origin to destination the impact of changing the transportation energy balance fluctuates.

As a general characteristic pattern of total commodity and goods movement, consider the data from a recently completed study (Table 1). These data were collected from a mailed survey sent to all firms in the three regions outlined in Figure 1 for which the Iowa Employment Security Commission records indicated that 20 or more persons were employed at one address during September, 1972. No statistical differences existed in the responses by region. As indicated in Table 1, the movement of commodities and goods is strongly dominated by trucking, even when the percentages are calculated on the volume of commodity shipped. If the transportation energy balance shifts away from trucking it might significantly impact the demand for rail transportation services to accomodate movements in and out of such rural regions.

The degree to which these commodity and goods movements are of a local nature must be considered before estimating the impact of changes in price and/or allocation of transportation fuels. Table 2 indicates the distribution of origins and destinations of the movements associated with data of Table 1. Assuming that a suitable definition of a "local" movement might be one which has both origin and destination within the same county or within the same planning region, well over 70 percent of all the movements were not local. These movements may be susceptible to business decisions to shift modes if transportation costs or availability of transportation services change as a result of changes in transportation energy balance. Local movements would be unlikely to shift from truck to rail due to the robustness of trucking as a transport mode (it approaches a truly demand-responsive service in functional character as an industry whole). Before considering the potential impact of transportation energy changes on these movements it is appropriate to examine the source-sink movements of the three categories of movements previously itemized.

## Agricultural Produce Flow

Agriculture produce can have directional flow demands to interchange between areas of production and consumption for several reasons. The movement may be a raw material shipped to a processing area to yield a manufactured agricultural product for further consumption (either human consumption, animal consumption, or industrial consumption), or the movement may be to an area for final consumption (human, animal, industrial or export). Source nodes can be identified as the production centers of agricultural production regions. One such delineation of the continental United States is shown in Figure 2 for a selected set of agricultural com-

Table 1. Selected responses to a business and industry survey (N = 171)

| Means of transportation for shipment | Respondents using | | Volume transported | |
|---|---|---|---|---|
| | Inbound | Outbound | Inbound | Outbound |
| | Percent | | | |
| Trucks | 79.47 | 79.40 | 79.49 | 67.12 |
| Trailer on flatcar (TOFC) | 0.91 | 0.99 | 0.08 | 3.96 |
| Railroad (exclude TOFC) | 12.49 | 7.80 | 18.70 | 27.32 |
| Air freight express (except parcel post) | 0.38 | 0.20 | 0.15 | 0.04 |
| U.S. parcel post (surface) | 1.02 | 6.52 | 0.63 | 0.72 |
| U.S. parcel post (air) | 0.18 | 0.13 | 0.02 | 0.02 |
| Parcel services | 5.29 | 7.73 | 0.79 | 0.81 |
| Intercity bus | 0.24 | 0.34 | 0.12 | * |
| Other | 0.03 | 1.90 | 0.02 | 0.01 |

*Less than 0.0005

Source: (2).

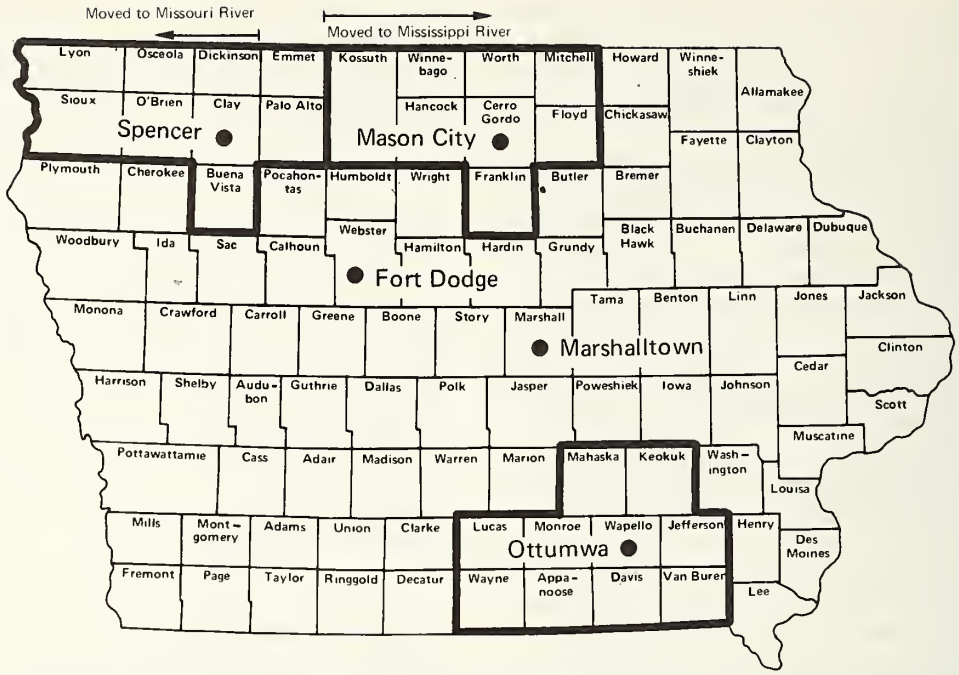



**Figure 1. Commodity and goods movement survey regions**

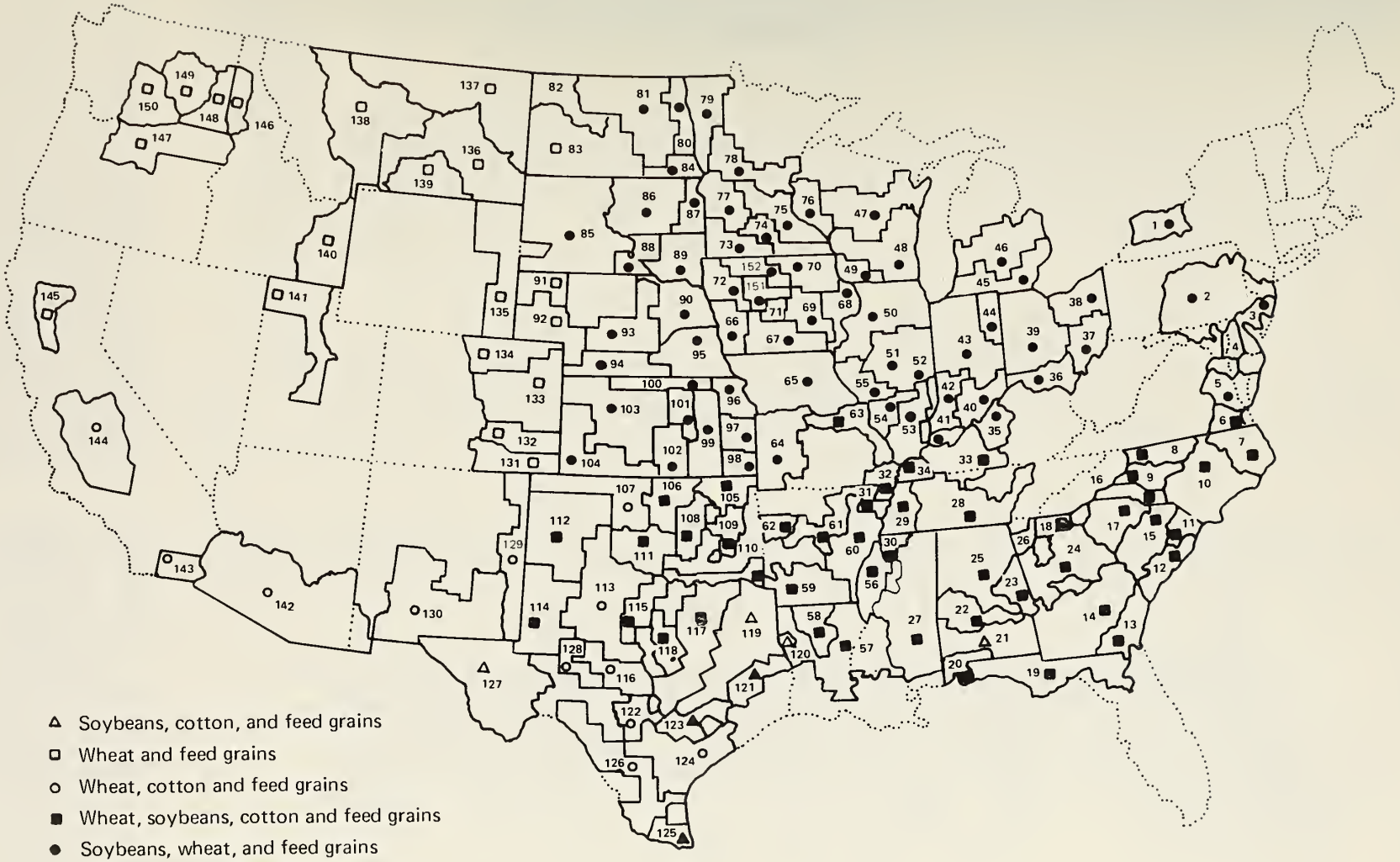
modities. For the commodities indicated (primarily cereal grains) these regions represent production zones both in the sense of commodity production and in the sense of a transportation movement (transportation planning analysis).

Sink nodes can be identified by delineating marketing regions and selecting consumption centers for each region. Figure 3 is one such delineation of grain consumption regions for the continental U.S. and Table 3 contains the associated nodes (consumption center) for each region. Development of sink nodes becomes a bit more tenuous than identification of source areas. Although the original agricultural source is distributed rather broadly over a large area, the product is collected and concentrated substantially for transport and, thus, the transportation centers can be effectively utilized as source nodes in any flow analysis. Human consumption centers are the

Table 2. Origin and destination of shipments by firms in three rural Iowa regions in 1973 (N = 171)

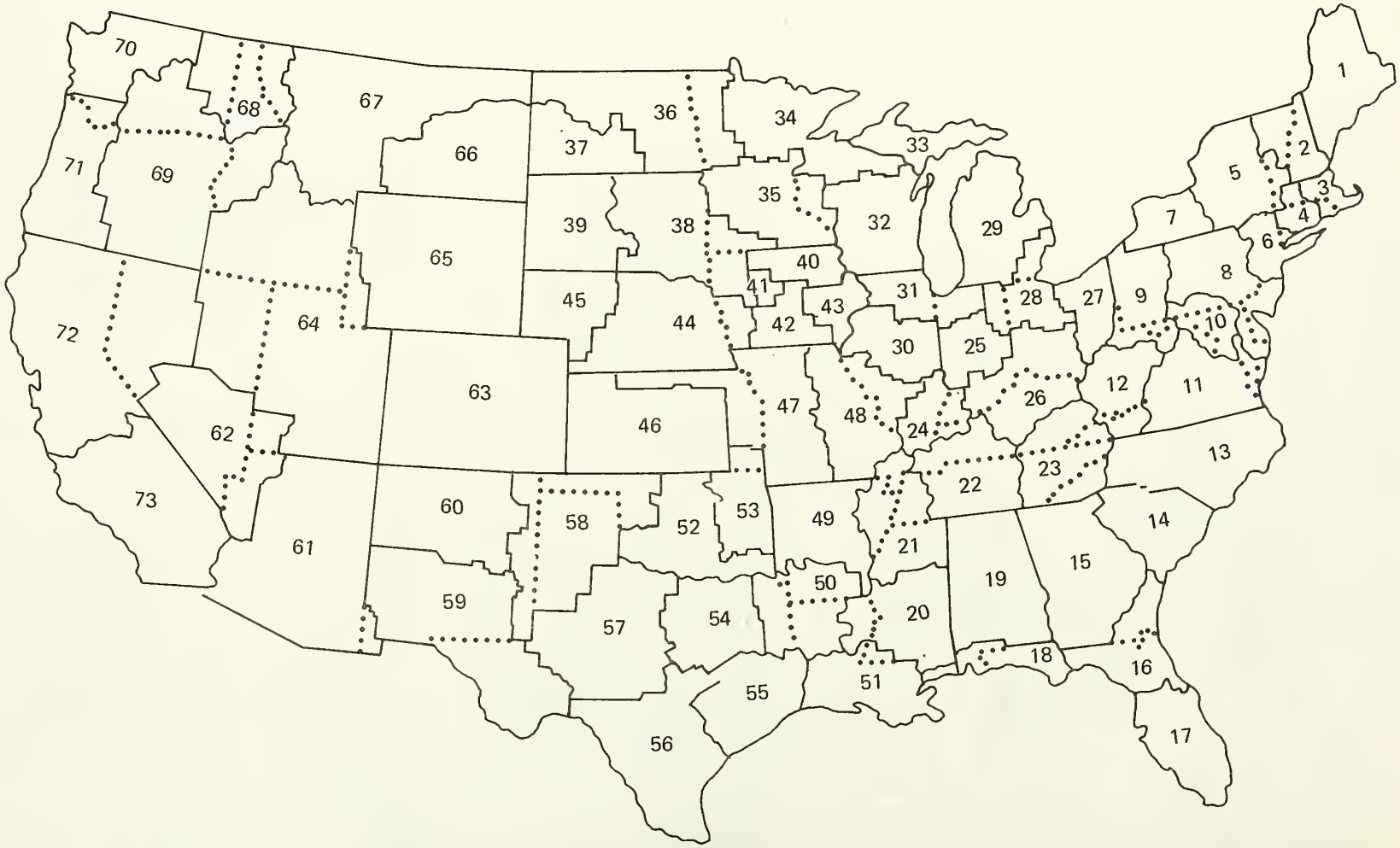
| Area of origin or destination | Goods originating in the area | Goods destinated for the area |
|---|---|---|
| | Percent | |
| County where firm is located | 15.46 | 17.41 |
| Central-place county of region in which firm is located (excludes responses from central-place county) | 2.20 | 1.68 |
| Other counties in the region in which firm is located | 4.96 | 8.70 |
| Remainder of Iowa | 18.22 | 23.90 |
| Outside Iowa | 59.17 | 48.31 |

Source: (2).


Soybeans, cotton, and feed grains
Wheat and feed grains
Wheat, cotton and feed grains
Wheat, soybeans, cotton and feed grains
Soybeans, wheat, and feed grains
Cotton and feed grains

Source: (4).

**Figure 2. Delineation of producing regions and crops grown by region**




Source: (4).

**Figure 3. Delineation of consuming regions**

Table 3. Consuming region numbers, hubs, and existence of demand for soybeans

| Number | Name of consuming region | Soybean demand[1] | Number | Name of consuming region | Soybean demand[1] |
|---|---|---|---|---|---|
| 1. | Waterville, Maine | | 40. | Mason City, Iowa | X |
| 2. | Concord, N.H. | | 41. | Fort Dodge, Iowa | X |
| 3. | Boston, Mass. | | 42. | Des Moines, Iowa | X |
| 4. | Hartford, Conn. | | 43. | Cedar Rapids, Iowa | X |
| 5. | Schenectady, N.Y | | 44. | Omaha, Nebraska | X |
| 6. | New York City, N.Y. | | 45. | Bridgeport, Nebraska | |
| 7. | Buffalo, N.Y.[2] | | 46. | Wichita, Kansas | X |
| 8. | Philadelphia, Pa. | X | 47. | Kansas City, Mo. | X |
| 9. | Pittsburgh, Pa. | | 48. | St. Louis, Mo. | X |
| 10. | Baltimore, Md.[2] | X | 49. | Little Rock, Ark. | X |
| 11. | Richmond, Va | X | 50. | Shreveport, La. | |
| 12. | Charleston, W. Va. | | 51. | Baton Rouge, La. | X |
| 13. | Raleigh, N.C. | X | 52. | Oklahoma City, Okla. | X |
| 14. | Columbia, S.C. | X | 53. | Tulsa, Okla. | X |
| 15. | Macon, Ga. | X | 54. | Ft. Worth, Texas | X |
| 16. | Jacksonville, Fla. | | 55. | Houston, Texas[2] | X |
| 17. | Tampa, Fla. | | 56. | San Antonio, Texas | |
| 18. | Mobile, Ala. | X | 57. | Abilene, Texas | X |
| 19. | Montgomery, Ala. | X | 58. | Amarillo, Texas | X |
| 20. | Jackson, Miss. | X | 59. | El Paso, Texas | |
| 21. | Memphis, Tenn. | X | 60. | Albuquergue, N.M. | |
| 22. | Nashville, Tenn. | X | 61. | Phoenix, Ariz. | |
| 23. | Knoxville, Tenn. | X | 62. | Las Vegas, Nev. | |
| 24. | Evansville, Ind. | X | 63. | Denver, Colo. | |
| 25. | Indianapolis, Ind. | X | 64. | Salt Lake City, Utah | |
| 26. | Cincinnati, Ohio | X | 65. | Casper, Wyo. | |
| 27. | Akron, Ohio | X | 66. | Billings, Mont. | |
| 28. | Toledo, Ohio[2] | X | 67. | Great Falls, Mont. | |
| 29. | Lansing, Mich. | | 68. | Spokane, Wash. | |
| 30. | Peoria, Ill. | X | 69. | Richland, Wash. | |
| 31. | Chicago, Ill. | X | 70. | Seattle, Wash.[4] | [3]X |
| 32. | Madison, Wisc. | | 71. | Portland, Ore.[4] | |
| 33. | Marquette, Mich. | | 72. | Sacramento, Calif.[4] | X |
| 34. | Duluth, Minn.[2] | X | 73. | Los Angeles, Calif.[4] | X |
| 35. | Minneapolis, Minn. | X | 74. | Albany, N.Y.[4] | |
| 36. | Fargo, N.D. | | 75. | Norfolk, Va.[4] | X |
| 37. | Bismark, N.D. | | 76. | New Orleans, La.[4] | X |
| 38. | Sioux Falls, S.D. | X | 77. | Corpus Christi, Texas[4] | |
| 39. | Rapid City, S.D. | | 78. | San Francisco, Calif.[4] | |

[1]An "X" indicates region has a demand for soybeans.
[2]Domestic and export region.
[3]Seattle has a demand only in models VIII and IX.
[4]Export region only.

SOURCE: (4).

large metropolitan population concentration centers. If an arbitrary population size of 500,000 persons in the 1970 Census of Population is taken to define a concentrated human consumption center, then there are 72 consumption centers of which 37 correspond to the consumption region hubs of Table 3 (10). Twenty of the consumption region hubs are the largest cities in a prime agricultural production region. For selected analyses some centers may be primarily consuming the product in terms of exportation.

The lack of congruence among the potential sets of sink nodes for different perceptions of the purpose of commodity movement can be partially overcome by defining a finer mesh network. However, a residual incongruence will always exist due to inequalities of the scale of consumption of agricultural produce in the three consumption categories identified. For in-

stance, exportation has been designated as a function of regions associated with Albany, Norfolk, New Orleans, Corpus Christi and San Francisco, while exportation and domestic consumption has been designated as a function of regions associated with Philadelphia, Baltimore, Toledo, Duluth, Houston, Seattle, Portland and Los Angeles (4). The export only regions also contain large human consumption populations so that such a classification even for only a single commodity (soybeans) provides some distinct analytical weaknesses when examining a problem as pervasive as the impact of transportation energy balance on commodity movement.

## CONSIDERATION OF ENERGY IMPACTS ON AGRICULTURAL MOVEMENT NETWORK

The degree to which agricultural commodities move to consumption centers for various consumption purposes will have a significant impact upon the potential modal demand shifts that may occur. The exportation of agricultural products (primarily grain) has been, and is expected to continue to be, a significant aspect of commodity movement from Iowa and the other Great Plains and Middle West states. In 1970–71, 12 Mid-America states produced over 47 percent of all U.S. agricultural exports (6). Since these exports move by transoceanic cargo ship out of seaports, the only modal consideration is how the produce moves from production area to exportation port. Changes in transportation energy balance could significantly shift modal use or the potential demand for use.

One reported analysis of the impact of fuel price increases on transportation costs for heavy grain by truck, rail and barge is shown in Table 4. Such data tends to indicate that a 20 cent per gallon increase in price, whether in taxes or transportation energy supply-demand stimulation, brings the fuel cost to a highly significant proportion of the total transportation cost. However, if the relative cost among the modes has not significantly changed, the modal splits might remain relatively constant. Comparison of the total shipping cost by mode indicates a 20 cent per gallon increase in the fuel price would cause the following modal cost ratio changes:

- truck/rail (100 miles)—1.1726 to 1.2977 (+11%)
- truck/rail (1,000 miles)—2.3581 to 2.5220 (+7%)
- rail/barge (1,000 miles)—2,8617 to 2.6557 (–7%)

It is not immediately obvious whether an increase in the relative cost between truck and rail of 11 percent would shift short haul movements from truck to rail. It is intuitively doubtful that for short movements rail can displace truck as the dominant mode, especially when factors such as convenience of service and availability of direct trucking access to production site is considered. This hypothesis is strongly supported by data from an Iowa Department of

Table 4. Effect and significance of increased fuel prices on select heavy grain transportation costs

| Mode, weight of shipping unit, and one-way distances | Total fuel cost | | Total shipping cost $ per ton-mile | | Fuel as a percent of total cost | |
|---|---|---|---|---|---|---|
| | Low fuel price[1] | High fuel price[2] | Low fuel price[1] | High fuel price[2] | Low fuel price[1] | High fuel price[2] |
| Truck[3] (24 tons, 100 miles) | 10.80 | 18.80 | 0.02147 | 0.02480 | 20.96 | 31.58 |
| Rail (97.5 tons 100 miles) | 4.29 | 12.09 | 0.01831 | 0.01911 | 2.40 | 6.49 |
| Truck (24 tons, 1000 miles) | 108.00 | 188.00 | 0.01903 | 0.02237 | 23.64 | 35.02 |
| Rail (97.5 tons, 1000 miles) | 42.9 | 120.90 | 0.00807 | 0.00887 | 5.46 | 13.99 |
| Barge (1400 tons, 1302 miles) | 519.84 | 1465.01 | 0.00282 | 0.00334 | 10.10 | 24.04 |

[1]The low fuel price is 27 cents a gallon for trucks and 11 cents a gallon for rail and barge.
[2]The high fuel price is 47 cents a gallon for trucks and is 31 cents a gallon for rail and barge.
[3]Distances are one-way, but costs are for round trips.

SOURCE: (4).

Transportation Survey of commodity movements in and out of barge grain terminals in Iowa (5) as displayed in Figure 4 and Table 5. The current 17 percent differential in short haul transportation costs does not prevent large volumes of grain from moving to Iowa barge terminals up to about 100 miles distant. The heavy line along the county boundaries is the approximate 100 mile distance from each river. Note the effect of the Interstate 80 corridor along Polk, Jasper, Poweshiek and Iowa Counties in the center of the state in attracting significant truck tonnage to the Mississippi River terminals at distances well over 100 miles. This is a crude measure of the influence of service rather than cost in the movement of an agricultural product.

The data in Table 4 are based on the transport vehicle moving loaded one-way and returning empty. The possibility of moving loaded in both directions is technologically more feasible with smaller, more flexible transporters (i.e., trucks). A recently reported study of the energy efficiency of truck movements provided the basis for the information in Table 6 (1). Table 4 cost data assume fuel efficiencies of 0.0167 gallon per ton-mile for trucks, 0.004 gallon per ton-mile for railroads and 0.0026 gallon per ton-mile for barges. It appears that large fuel efficiency gains may be possible for even partial loads on the backhaul.

Increased cost factors in the transportation energy balance appear then to have possible modal shifts of:

- more distinctly defining the distance at which it is desirable to truck to reach a rail or barge change-of-mode terminal;
- making the cost of rail more competitive to barge in a relative sense due to more direct distance paths for many movements;
- shifting of more traffic to rail in general.

## CONSIDERATION OF ENERGY IMPACT IN OTHER MOVEMENT NETWORKS

Two communities of industrial movements were analyzed for size of shipments to out-bound and inbound (9). Due to the masses of data involved for any large firm for a one-year sample and the need to aggregate data to mask the effect of one very large shipper, a selected sample of five firms in each of Fort Dodge, Iowa, and Marshalltown, Iowa, was examined. The distribution of size of shipments out-bound is shown in Figures 5 and 6. In-bound shipments were distributed with essentially an exponential decay of the form displayed by the out-bound distribution up to 10,000 pounds. As shown by both figures, the *vast* majority of these movements are less than truck load or car load lots. Fuel efficiencies for either truck or rail drop dramatically and the impact of fuel cost increases can only be absorbed in one of two ways over the short-term (e.g., sudden rise in OPEC prices). One way is to increase the cost of services to the shipper. If regulation or the market place constrains shipper rate increases, the alternative is reduced service. It may be that as transportation energy becomes more scarce decreased service will be the short-term preference of consuming individuals in large urban areas (with political clout) until the capability to adequately support the distribution of agricultural produce and products manufactured in an agricultural region is dangerously impaired. This is an especially critical factor since the movements associated with such regions have been found to be predominantly external to the region.

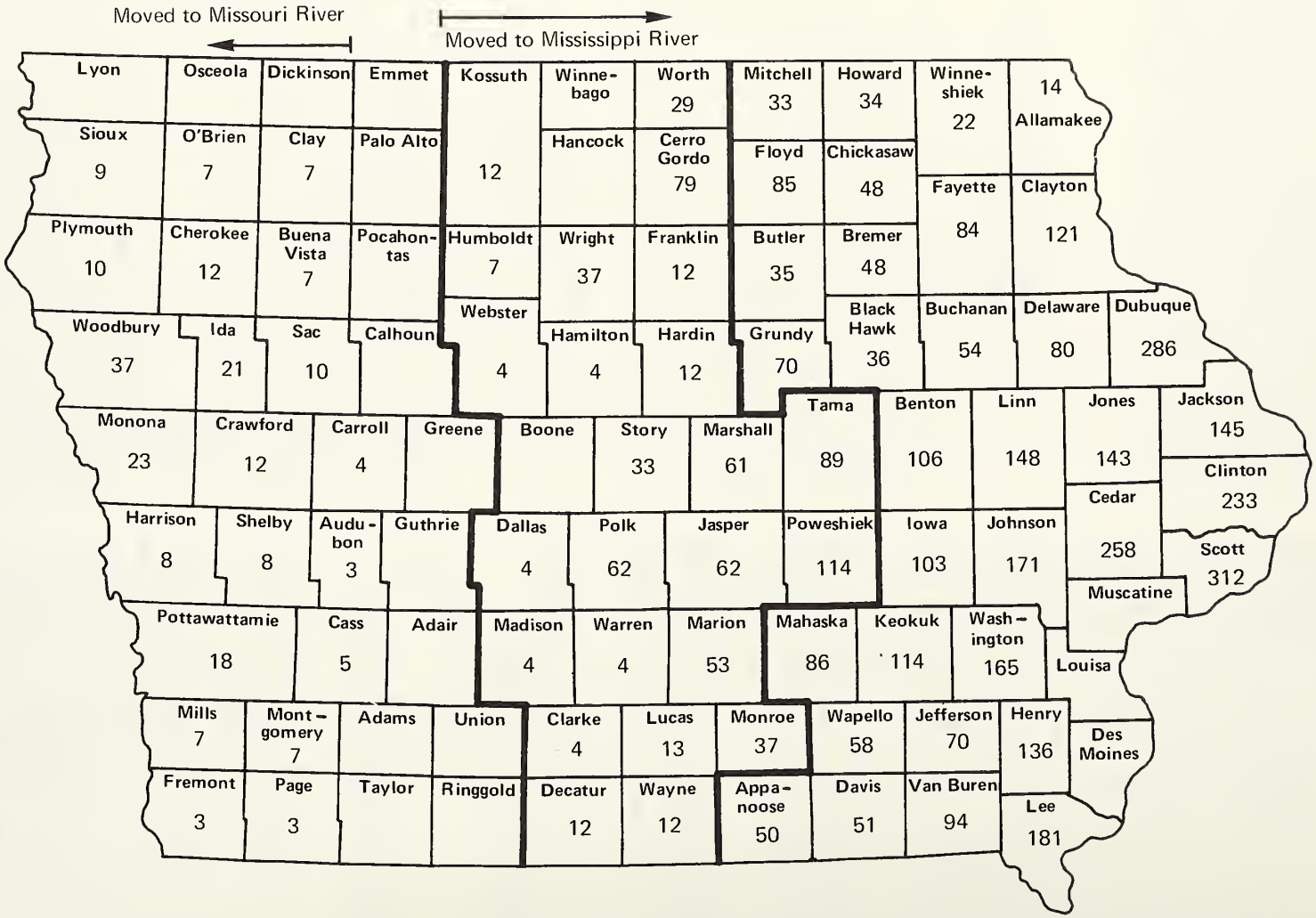
## INTERRELATIONSHIPS OF ENERGY AVAILABILITY TO COMMODITY MOVEMENTS

Price and cost fluctuations can be accomodated in the market place even if such accomodation is painful. Transportation planning models of a simple econometric nature can also estimate the sensitivity of transportation mode demands to price and cost fluctuations. The sensitivity of transport mode demand to the availability of fuel, irrespective of price and cost, is a very real problem with many facets. Some of these are:

- the distribution of the potential to consume energy among competing sectors of society,
- the distribution of demand among consumer sectors with the potential to alternate energy sources,
- the absolute finiteness of each existing and potential energy supply (source),
- the perception to the above by individuals making decisions in personal travel, business transport, and public polity.

The nature of the potential to consume energy in the various competing sectors is briefly indicated by Table 7. Traditional estimates of the consumption of energy allocates about 25 percent to transportation, about 25 percent to industrial uses, about 25 percent to residential consumption, and about 25 percent to other. It is obvious that we have a huge capability to consume energy in transportation and that the degree to which our automotive prime movers are idle is all that precludes us from having a worse energy shortage.

The capability to alternate energy sources is almost exclusively limited to factories and electric generating stations. Fuels commonly utilized in these sectors include coal, electricity, natural gas, propane, and fuel oil number 1, fuel oil number 2, and fuel oil number 6. A recent survey by the Engineering Research Institute of 661 businesses and industries in Iowa yielded the current estimates of manufacturing energy consumption shown in Table 8 (7). These data indicate that a substantial proportion of the energy is natural gas currently. Twelve to 18




Source: (5).

**Figure 4. Tonnage of grain moved by truck to Iowa barge terminals (estimated 1974)**

Table 5. Total estimated tonnage movements by mode to Iowa barge terminals in 1974 (1,000's)

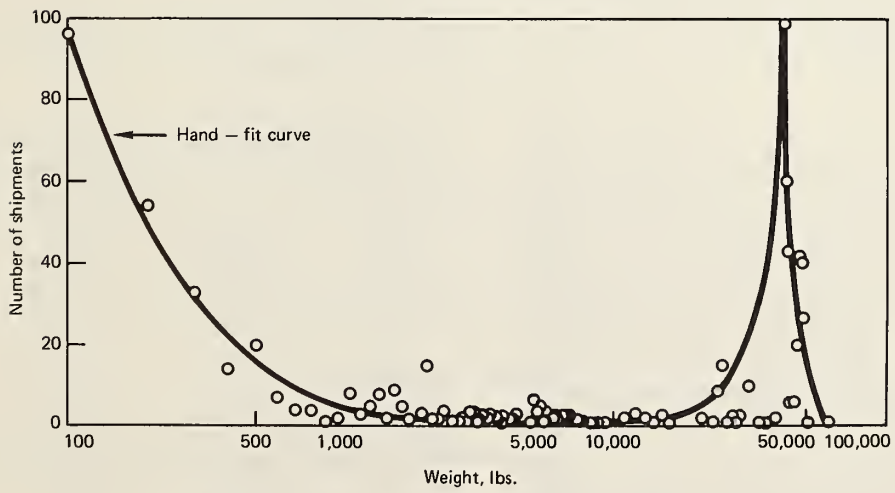
| Movement origin area and/or mode | Missouri River terminals | | Mississippi River terminals | |
|---|---|---|---|---|
| Iowa origin by truck | 221 | (65%) | 4,920 | (80%) |
| Origin outside Iowa by truck | 120 | (35%) | 1,256 | (20%) |
| Total truck | 341 | (88%) | 7,154 | (79%) |
| Total rail | 47 | (12%) | 1,872 | (21%) |
| Total received | 388 | (100%) | 9,026 | (100%) |
| Used on site | 0 | (0%) | 1,234 | (14%) |
| Total barge | 388 | (100%) | 7,792 | (86%) |

Source: (5).

Table 6. Fuel efficiency of trucks

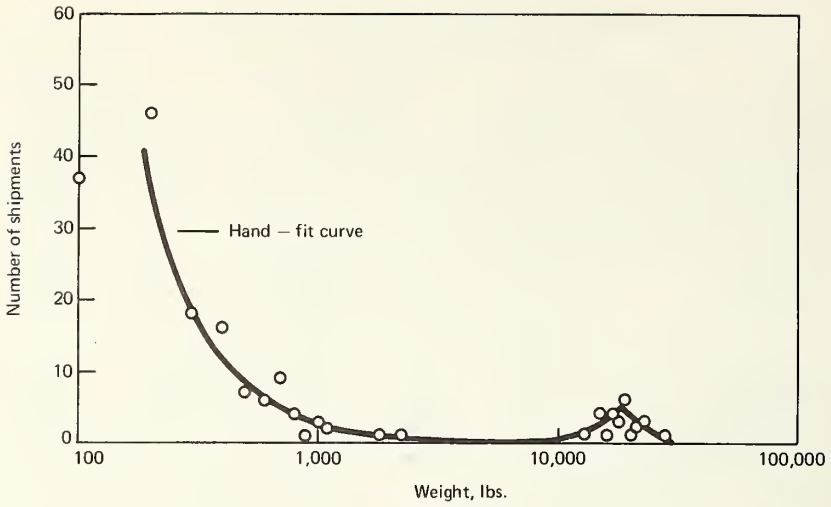
| Gross Vehicle weight loaded | Payload | Efficiency | |
|---|---|---|---|
| | | Loaded both ways | Loaded one-way |
| Pounds | Tons | Gallons per ton mile | |
| 27,500 | 7.7 | 0.02631 | 0.05263 |
| 44,000 | 14.7 | 0.1562 | 0.03125 |
| 58,000 | 20.0 | 0.01265 | 0.02500 |
| 65,000 | 22.6 | 0.01162 | 0.02325 |
| 73,000 | 25.5 | 0.01087 | 0.02173 |
| 82,000 | 28.5 | 0.01020 | 0.02040 |
| 91,000 | 31.2 | 0.00980 | 0.01960 |
| 100,600 | 34.4 | 0.00934 | 0.01851 |

SOURCE: (1).




Source: (9).

**Figure 5. Frequency distribution of weights of outbound shipments, Fort Dodge, Iowa**




Source: (9).

**Figure 6. Frequency distribution of weights of outbound shipments, Marshalltown, Iowa**

Table 7. Total horsepower of all prime movers

| Sector | Millions of horsepower | |
|---|---|---|
| | 1960 | 1972 |
| Automotive | 11,008 | 22,913 |
| Factories | 42 | 57 |
| Mines | 35 | 46 |
| Railroads | 47 | 57 |
| Marine | 24 | 21 |
| Farms | 240 | 305* |
| Electric stations | 217 | 508 |
| Aircraft | 37 | 181 |

*Includes about 1,400,000 H.P. in animals and 15,000 H.P. in windmills

SOURCE: (10, p. 514).

Table 8. Iowa manufacturing energy consumption (N = 661)

| Type of energy | 1975 | 1980 (est.) | 1985 (est.) |
|---|---|---|---|
| | Trillions of BTUs | | |
| Total consumption | 199.5 | 230.2 | 250.2 |
| Natural gas | 139.7 | 137.5 | 129.3 |
| Propane | 4.0 | 4.7 | 6.4 |
| Fuel oil #1 | ---------- nominal ---------- | | |
| Fuel oil #2 | 5.0 | 4.1 | 25.4 |
| Fuel oil #6 | 2.7 | 5.6 | 10.6 |

months ago, the major supplier of natural gas began to publicly announce that by 1978 most industrial users in Iowa would be interrupted or terminated as customers. The most current estimates of termination are 1981 and these estimates were included in the survey form. Note in Table 7 that business leaders' plans to shift energy sources (where such plans existed) represent a substantial intrusion into fuels derived from petroleum. A minimum capital investment and minimum inconvenience route is apparently being pursued.

A more chilling and telling aspect of business decisions related to curtailment of natural gas consumption is illustrated in Table 9. More than half of the firms plan to continue increased consumption! A *few* have already made special efforts to convert to electricity or direct consumption of coal. A sudden cutoff of natural gas implies an emergency effort to utilize fuel oils, at least temporarily, with a sudden

Table 9. Natural gas conservation plan matrix

| 1975-1980 Business Plans | 1980-1985 Business Plans | | |
|---|---|---|---|
| | Decrease | Constant | Increase |
| Decrease: | 7.7% | 5.0% | 1.0% |
| Constant: | 1.3% | 17.4% | 0.2% |
| Increase | 6.9% | 9.0% | 51.5% |

crimp in transportation energy resulting. Further impact on agriculture is generated in that "food and kindred products" consumed 50.8 percent of the energy in 1975 and is still estimated to be 44.6 and 41.6 percentages in 1980 and 1985 respectively.

Business decisions being non-responsive to energy issues impacting transportation may be acceptable if personal and household travel decisions are influenced by conservation needs due to the large potential to save fuel in automotive transportation. Three separate surveys were mailed to an unbiased selection of one third of a sample group of 7,086 households in Iowa in December 1974 during an Engineering Research Institute research effort sponsored by the U.S. Department of Transportation. The entire study results have been reported elsewhere (8). Two findings related to the discussion at hand are that during the 1973–74 winter of transportation energy shortage, people did, in fact, make some changes in their life style (see Table 10), and that people don't really want to do anything very seriously disruptive as a policy action (see Table 11). Basically, people made adjustments in their lives which were limited to easily reversed actions. A further study of policy preferences has indicated that the elderly prefer policies that allow purchasing larger quantities of fuel at higher prices, and the high income seek policies without time penalties (3). Business decisions (including transportation decisions) are being made by people with the same basic motivations as represent the population in the aggregate. People cannot identify the reality of the empirical data presented on future energy situations in any terms that have value in their decision-making processes.

## FUTURE RESEARCH

A fundamental study direction that this author, with a colleague, is pursuing in an attempt to delineate the behavior process in travel decisions is outlined in Figure 7. This proposed structure to model person and household have evolved from the concepts of phenomenology and the concepts of social conflict in that decisions about travel are negotiated. This negotiation takes place in the context of the empirical world perceived as applicable to the individual and with respect to the constraints

Table 10. Rank order of transportation behavior changes (percent answering "yes" to the question "Have you (or any members of your household) made any of the following transportation-related changes during the last year?"

| Variable code | Description | Percent answering "yes" |
|---|---|---|
| C-1 | Driven slower | 93.8 |
| A-1 | Cut down on trips by combining shopping with "running errands," going to work, etc. | 76.0 |
| A-2 | Taken fewer "Sunday rides" | 70.4 |
| A-3 | Shopped closer to home | 58.5 |
| A-4 | Used the car less in the evenings for meetings and children's activities | 49.2 |
| A-5 | Changed vacation or travel plans | 43.0 |
| A-6 | Walked or biked to more places | 38.5 |
| C-2 | Bought a car that uses less gas | 23.3 |
| B-1 | Looked for a job requiring less travel | 13.0 |
| B-2 | Formed or joined a car pool | 11.5 |
| B-3 | Made greater use of buses | 7.4 |
| B-4 | Looked for a home closer to job | 6.6 |
| B-5 | Looked for a job closer to relatives, stores, health services, or friends | 4.0 |

SOURCE: (8).

Table 11. Rank order of percent answering "very favorable" or "somewhat favorable" to 14 Policy Preferences

| Variable code | Description | Percent favorable Form A | Form B |
|---|---|---|---|
| F-3 | Strict enforcement of the 55-mph speed limit | 78.5 | 85.4 |
| J-1 | More government controls on gas (oil) companies | 73.9 | 77.6 |
| G-2 | Government support to encourage bus riding | 70.5 | 81.4 |
| G-1 | Special privileges for car pools | 66.1 | 81.4 |
| F-4 | Reducing the amount of allowable air travel | 57.5 | 64.3 |
| E-1 | Gas rationing | 36.6 | 42.9 |
| F-2 | Closing recreational areas on Sunday | 34.3 | 30.8 |
| E-2 | Enforced policy of alternate gas buying days | 28.4 | 33.4 |
| I-1 | Depending more on gas from other countries | 27.0 | 20.3 |
| F-1 | Banning weekend driving | 24.4 | 25.4 |
| H-1 | Taxing cars getting less than 20 mpg | 23.3 | 27.1 |
| D-4 | Higher taxes to finance the development of new energy sources | 21.7 | 37.9 |
| D-5 | Adding a $0.30 per gallon gas tax | 7.9 | 8.6 |
| D-3 | A $3.00 a gallon gas price | 2.5 | 2.0 |

SOURCE: (8).

imposed by the persons, institutions and technological systems perceived as being involved in the decision. Thus, each travel alternative has a tradeoff value with respect to each constraint. The problem is to define this tradeoff point.

Business decisions are cast in the same mold except now the persons are representing organizations instead of households. Transportation energy balance (cost, availability) is only one constraint among many facing the decision-maker. Currently it is not very highly valued so the tradeoff always seems to tip in the direction of service changes. We need to know what kinds of situations can be understood and conceptualized sufficiently that a decision-maker can foresee the system impact of an ever present possibility of a sudden change in the transportation energy balance.

## FOOTNOTE

[1]The support of the Engineering Research Institute in the preparation of this paper is gratefully acknowledged.

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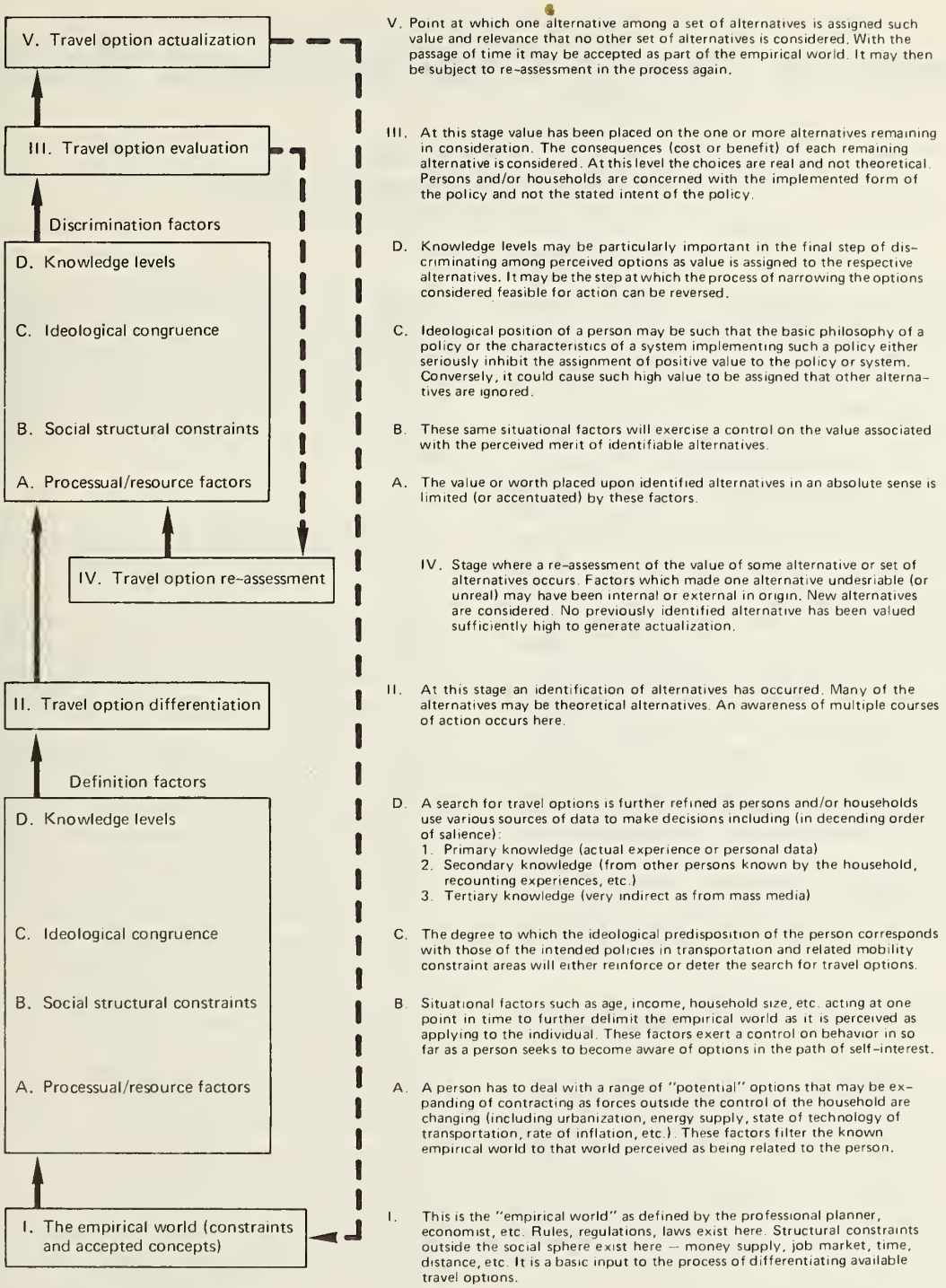
V. Travel option actualization
V. Point at which one alternative among a set of alternatives is assigned such value and relevance that no other set of alternatives is considered. With the passage of time it may be accepted as part of the empirical world. It may then be subject to re-assessment in the process again.
III. Travel option evaluation
III. At this stage value has been placed on the one or more alternatives remaining in consideration. The consequences (cost or benefit) of each remaining alternative is considered. At this level the choices are real and not theoretical. Persons and/or households are concerned with the implemented form of the policy and not the stated intent of the policy.
Discrimination factors
D. Knowledge levels
D. Knowledge levels may be particularly important in the final step of discriminating among perceived options as value is assigned to the respective alternatives. It may be the step at which the process of narrowing the options considered feasible for action can be reversed.
C. Ideological congruence
C. Ideological position of a person may be such that the basic philosophy of a policy or the characteristics of a system implementing such a policy either seriously inhibit the assignment of positive value to the policy or system. Conversely, it could cause such high value to be assigned that other alternatives are ignored.
B. Social structural constraints
B. These same situational factors will exercise a control on the value associated with the perceived merit of identifiable alternatives.
A. Processual/resource factors
A. The value or worth placed upon identified alternatives in an absolute sense is limited (or accentuated) by these factors.
IV. Travel option re-assessment
IV. Stage where a re-assessment of the value of some alternative or set of alternatives occurs. Factors which made one alternative undesriable (or unreal) may have been internal or external in origin. New alternatives are considered. No previously identified alternative has been valued sufficiently high to generate actualization.
II. Travel option differentiation
II. At this stage an identification of alternatives has occurred. Many of the alternatives may be theoretical alternatives. An awareness of multiple courses of action occurs here.
Definition factors
D. Knowledge levels
D. A search for travel options is further refined as persons and/or households use various sources of data to make decisions including (in decending order of salience):
1. Primary knowledge (actual experience or personal data)
2. Secondary knowledge (from other persons known by the household, recounting experiences, etc.)
3. Tertiary knowledge (very indirect as from mass media)
C. Ideological congruence
C. The degree to which the ideological predisposition of the person corresponds with those of the intended policies in transportation and related mobility constraint areas will either reinforce or deter the search for travel options.
B. Social structural constraints
B. Situational factors such as age, income, household size, etc. acting at one point in time to further delimit the empirical world as it is perceived as applying to the individual. These factors exert a control on behavior in so far as a person seeks to become aware of options in the path of self-interest.
A. Processual/resource factors
A. A person has to deal with a range of "potential" options that may be expanding of contracting as forces outside the control of the household are changing (including urbanization, energy supply, state of technology of transportation, rate of inflation, etc.). These factors filter the known empirical world to that world perceived as being related to the person.
I. The empirical world (constraints and accepted concepts)
I. This is the "empirical world" as defined by the professional planner, economist, etc. Rules, regulations, laws exist here. Structural constraints outside the social sphere exist here — money supply, job market, time, distance, etc. It is a basic input to the process of differentiating available travel options.

**Figure 7. Travel decision model based on the concept of phenomenological definition of reality as a behavioral theory.**

(8) Richards, R. O., et al., Integrated Analysis of Small Cities Intercity Transportation to Facilitate the Achievement of Regional Urban Goals: Intercity Transportation in Rural Regions: Volume II—Regional Factors and Analyses. Report No. DOT-TST-76-43, Off. of Univ. Res., U.S. Dept. of Transportation, May 1976.

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# Impacts of Energy Costs on Rural Mobility

Erhardt O. Rupprecht
Agricultural Economist, Economic Research Service
U.S. Department of Agriculture

Rural America's dependence on private motor vehicles was demonstrated in yesterday's paper "Private Motor Vehicles—Rural America's Pervasive Transportation Mode." Personal mobility in rural areas can, therefore, be seriously affected by price changes or reductions in the supply of motor fuels. Today we will briefly examine the monetary impacts of changes in gasoline prices on households. However, apart from direct effect on the household budget examined here, significant increases in fuel prices and supplies can have important multiplier effects on the economy.

Since the early part of 1974, sharply higher gasoline prices have become a fact of life for American drivers. These increases directly affect household incomes and consumer welfare. The severity of the impact depends on a number of factors including distance to jobs and shopping, the number of vehicles owned and their gas mileage, the availability of alternative transport modes and the household income. Rural households, and particularly farm households, face rather severe impacts because most of the above characteristics generally are less favorable for them than for urban households in terms of fuel use, as will be documented below.

## REACTIONS TO HIGHER FUEL PRICES

Given a significant increase in fuel prices, a household may be willing to adjust its use of transportation to offset some of the income otherwise diverted to fuel purchase or perhaps lost, due to these higher prices. A household may switch to less fuel intensive modes, reduce the traveling distance or consolidate trips in attempting to offset these price increases. For example, carpooling or public transit may be used for work trips, reducing commuting costs and increasing the household's net income to purchase other goods. Unless the household alters its expenditure pattern it will be forced to consume less of other goods. Economists view this alteration as depending on the household's preferences and the magnitude and direction of income and substitution effects (1 and 4).

The problem for rural households is that these alternatives may be more difficult to implement. The choice of reducing distances for many rural trips may not exist. In addition, fewer alternatives to private motor vehicles, such as public transportation or even walking, may exist or be feasible. Carpooling may be more difficult because of the more scattered origin and destination patterns in rural areas. In particular, farm households use private vehicles extensively to conduct farm business, and higher gasoline prices affecting this use impact on farm household welfare also.

## CHARACTERISTICS OF RURAL-URBAN TRANSPORTATION

As hypothesized, under higher fuel prices rural households may incur greater losses of purchasing power and welfare than would urban households. Some data on rural-urban transportation characteristics are available for a preliminary evaluation of the hypothesis. Rigorous analysis using these data is difficult because some travel by light truck is not reported and as noted yesterday, this mode is an important form of personal mobility in rural areas. In addition, the available statistics are reported for residential classifications—unincorporated areas and incorporated places—that do not exactly conform to the standard rural-urban designations (5, 6, and 7). However, some general observations are possible. Average one-way automobile trip lengths for all purposes are generally longer in unincorporated areas, incorporated places with under 5,000 people and incorporated places with one million or more population, where trip lengths of 10, 10-1/2 and 11-1/2 miles, respectively, occur (table 1). However, the data obscure some special rural characteristics: for example, farmers and farm managers have the longest average trip lengths for family business trips, over 11 miles, more than double the length for other occupational groups (7, p. 71). Also, there are fewer opportunities for reducing work and other trips lengths in farming and other countryside areas than in metropolitan areas.

The number of automobile (including taxi) trips and the vehicle-miles traveled by a household in various areas and places yield further insight into possible adverse impacts of higher fuel prices. Households in unincorporated areas made about 1,600 trips a year on the average. This total is almost 15 percent more than the national average of 1,400 trips and over twice as many as those by households in the largest incorporated places. Households in unincorporated areas traveled 15,400 vehicle-miles a

Table 1. Annual trips, vehicle-miles and average trip length per household according to residence and purpose, 1969-70[1]

| Purpose | Unincorporated areas | Incorporated places | | | | | | All places and areas |
|---|---|---|---|---|---|---|---|---|
| | | Under 5,000 | 5,000-24,999 | 25,000-49,999 | 50,000-99,999 | 100,000-999,999 | One million and over | |
| | | | | Annual trips | | | | |
| Earning-a-living | 561 | 401 | 661 | 511 | 481 | 438 | 324 | 506 |
| Family business | 493 | 297 | 601 | 480 | 430 | 369 | 181 | 432 |
| Social and recreational | 336 | 278 | 421 | 343 | 299 | 286 | 125 | 312 |
| Other | 178 | 80 | 187 | 145 | 134 | 133 | 70 | 146 |
| Total all purposes | 1,568 | 1,056 | 1,870 | 1,479 | 1,344 | 1,226 | 700 | 1,396 |
| Average daily trips | 4.3 | 2.9 | 5.1 | 4.1 | 3.7 | 3.4 | 1.9 | 3.8 |
| | | | | Vehicle-miles | | | | |
| Earning-a-living | 6,438 | 4,124 | 6,180 | 4,682 | 4,275 | 3,801 | 4,155 | 5,166 |
| Family business | 3,316 | 2,271 | 2,675 | 2,177 | 2,087 | 1,649 | 1,027 | 2,401 |
| Social and recreational | 4,455 | 3,946 | 5,086 | 4,202 | 4,016 | 3,426 | 2,580 | 4,094 |
| Other | 1,178 | 635 | 755 | 540 | 462 | 523 | 448 | 762 |
| Total all purposes | 15,387 | 10,976 | 14,696 | 11,601 | 10,840 | 9,399 | 8,210 | 12,423 |
| Average daily vehicle-miles | 42.1 | 30.1 | 40.2 | 31.8 | 29.7 | 25.8 | 22.5 | 34.0 |
| | | | | Average trip length (miles) | | | | |
| | 9.8 | 10.4 | 7.9 | 7.8 | 8.1 | 7.7 | 11.7 | 8.9 |

[1]For trips where an automobile or taxi was the predominant mode used.

Source: (6, pp. 16-17 and 7, p. 16).

year and averaged 42 vehicle-miles a day—more than households in any other residential grouping.

Households in the smallest incorporated places had particularly interesting trip characteristics. They made next to the lowest average number of annual trips, about 1,050. Perhaps some of their trip needs are met by walking. However, they had the fourth highest number of vehicle-miles since their average trip length was rather long.

Households in incorporated places with population between 5,000 and 24,999 had the highest number of annual trips, 1,900, and the second highest vehicle-miles, 14,700.

Households in the largest incorporated places made the fewest number of automobile trips annually, 700. They also had the lowest annual vehicle-miles of all the residential groupings, 8,200. As the population increased, there was an inverse relation-

ship to vehicle-miles of travel. Increased use and availability of public transportation may partially account for this. Over 50 percent of the vehicle-miles of households in the largest incorporated places were logged on occupational trips in contrast to residents of other jurisdictions where such trips accounted for only about 40 percent of the annual vehicle-miles.

Rural areas and places usually lack alternative modes (9). Households in these areas make greater use of their automobiles, as shown by the trip and vehicle-mile figures.

## AUTOMOBILE FUEL USE

The relative energy efficiencies of rural and urban automobiles also deserve considerations. Motor vehicles operating in a congested urban environment have poorer gas mileage than those operating on relatively open roads. Traffic signals and peak-hour-traffic loads in urban areas cause a cycle of speed variations that result in greater gasoline consumption. Hirst has estimated that urban autos are a highly energy intensive transport mode; they require more British Thermal Units (BTU's) per passenger mile, 8,100 BTU's, than all other passenger modes except airplanes. Intercity autos, on the other hand, are more than twice as efficient as urban autos; at 3,400 BTU's per passenger mile, they rank below urban mass transit in terms of energy used. A part of this difference is due to a higher occupancy rate for intercity travel (3).

We can calculate gallons of gasoline consumed by applying the miles per gallon (mpg) figures to the vehicle-mileage data. Automobiles in the United States average about 13 mpg. However, it is estimated that urban fuel consumption is 11.5 mpg, while rural consumption is 15.5 mpg (2). Of course, considerable variation could occur because of terrain, driver operation, load, vehicle weight, and mechanical condition of the vehicle.

Assuming that all the "rural" vehicle-miles are operated in relatively uncongested areas, the household in the unincorporated area would consume about 1,000 gallons of gasoline annually. The household in the largest incorporated place, traveling in a congested environment, would use about 700 gallons. Thus, in this polar case, the rural household consumes about 40 percent more gasoline but travels almost twice as many vehicle-miles as the urban household. Other assumptions would result in a narrower differential in gasoline consumption between these two types of households.

A gasoline price increase of 25 cents a gallon would increase the cost of transportation by $250 for the household in the unincorporated areas. The household in the largest urban area would pay only $175, assuming no change in travel habits. However, since the rural households probably have fewer opportunities to reduce travel distances or switch to alternative modes, welfare impacts would potentially be greater for them.

A reasonably accurate assessment of the monetary impacts on farm households of higher gasoline prices is also possible by using mileage data for farm households as shown in yesterday's paper and making some estimates of gasoline consumption based on sizes and modes of cars and light trucks on farms in 1975. The Environmental Protection Agency (EPA) has been releasing miles per gallon (mpg) figures for the various makes and models each year. They present data on both city and highway driving. Since highway mpg figures ". . . includes rural and interstate driving . . ." they should be reasonably representative of rural mpg (8).

Farm households are highly dependent on private motor vehicles. Preliminary indications suggest that they drive more miles annually than urban households. This is due in part to the longer distances they must drive and also their access to and multiple uses of vehicles such as pickup trucks. Farm households also use automobiles and light trucks in carrying on farm business and in commuting to off-farm jobs. Given these characteristics, increases in energy prices probably will impact on them more severely than on urban households who can switch to alternative modes or reduce travel distances.

As energy supplies tighten in the future, the transportation characteristics of farm and rural households must be taken into account if the burdens of adjustments are to be allocated equitably among the urban and rural population and so as to prevent excessive dislocations. The indirect effects on rural development, agricultural production, and quality of life in rural areas could be considerable. We hope to delve more deeply into the data on vehicle types and uses now available for farm households in the future. In any event, the data base is a resource not available from other agencies as yet, but it became available too late for us to develop the data for this Symposium.

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# The Commonwealth of Pennsylvania's Role in Rural Passenger Transportation*

William W. Millar
Chief, Senior Citizen Transit Program,
Pennsylvania Department of Transportation

This paper will briefly describe the role of the Commonwealth of Pennsylvania in assisting the development of local rural passenger transportation in Pennsylvania. Intercity rail and bus transportation are not included in this discussion. At the present time the State of Pennsylvania does not operate any rural transportation systems of its own. As in many states, it supports through its various social welfare programs a variety of transportation activities in both rural and urban areas. However, this assistance usually takes the form of purchase of service contracts or grants in aid which may be used to purchase capital equipment such as vans or which may be used to cover operating expenses. Pennsylvania did operate a rural transportation demonstration project for nearly four years. However, it was terminated in December 1975. This will be described later in this paper.

In discussing rural transportation in Pennsylvania, it is necessary to distinguish between public sector and private sector transportation service providers. The private sector consists of Public Utility Commission authorized carriers, mainly taxicab companies and small bus companies and privately owned school buses. In Pennsylvania there are approximately 250 taxicab companies registered with the Public Utility Commission. These operate on a demand responsive basis though many also have group and party rights. The Commonwealth also has at least one hundred small bus companies operating both fixed route local transit service and charter service plus many additional companies which provide only charter service. Also included in the private sector are the owners of more than 10,000 contract school buses though their impact to date has been minimal in nonpupil transportation.

Most of these private sector carriers are located in or near urban areas; however, sizable portions of the rural areas of the State have at least some public transportation service provided by these private sector transportation companies. Like public transportation in urbanized areas the quality and quantity of private sector rural public transportation has declined markedly in the past thirty years.

With the development of the "Great Society" and "War on Poverty" programs in the 1960's it became apparent that if social services were to be offered or supported by the government the services would be of no value if people could not obtain transportation to utilize them. As noted above, much of the public transportation service provided by the private sector has declined for many years. Therefore, social service agencies often found it to be of little value to their clients in rural areas. For this reason many agencies began to provide some form of transportation for their clients. Typically this has meant either that an agency pays its personnel to carry clients to services or that the agency develops a transportation system of its own, usually through the purchase of one or more vans or station wagons which the agency then uses for its clients and its clients alone. Sometimes particular social service agencies have developed exceptionally strong transportation programs. The best examples in Pennsylvania are Community Action Agencies. Service provided has usually been small in scope, generally utilizing one to four vehicles, and it has been characterized by the lack of a consistent funding base and a high cost per passenger served. Nonetheless, social service agencies have often provided the only viable form of transportation for people in need.

In 1972, the Pennsylvania Department of Agriculture in cooperation with the Pennsylvania Department of Public Welfare and the Pennsylvania Department of Health participated in the development

*Editor's note: Topic suggested by Planning Committee was "Policies for the Elderly and Handicapped in the Rural Setting."

of a rural health demonstration program. The program covered four counties in southwestern Pennsylvania and served clients of low income. Its purpose was to upgrade the health care of rural Pennsylvanians in the area. Shortly after the program began it became apparent the low utilization rates of program services were due in large measure to the fact that many potential clients of the programs simply could not get to facilities in order to receive the benefits of the program.

To counter this problem the Pennsylvania Department of Agriculture set up a rural transportation demonstration project in the four counties. The project used state vehicles operated by state employees to drive clients from their homes to the various health centers participating in the medical program. Like most social service transportation, the cost per passenger was high but the program was viewed as a success and in 1974 it was expanded from four counties to twenty-one counties covering the southwest and northwest quadrants of the state and two counties in the northeastern portion of the state.

In large part because of the experience gained under this demonstration project and at the urging of the Pennsylvania Secretary of Agriculture, Governor Milton J. Shapp established a Rural Transportation Task Force in January 1974. The purpose of this Task Force was to study the need for rural passenger transportation in the Commonwealth and to make recommendations to the Governor on how these needs might be met. The Task Force commenced work immediately and by the end of May, 1974, had its report to the Governor. The report included the following findings and recommendations:

1) All residents of rural Pennsylvania be assured of access to transportation opportunities—both general-purpose and emergency services—to enable them to share in the benefits of modern society;
2) Certain elderly, handicapped, and disabled individuals should be assisted in purchasing transportation services;
3) The presently fragmented provision of transportation services by various Departments of the Commonwealth and non-state agencies be coordinated through a single agency;
4) Multi-modal rural transportation services of varying costs and quality be developed in coordination with the Commonwealth's development policies, the Pennsylvania Economic Program, and local involvement;
5) Existing transportation carriers be utilized to provide services wherever possible in accordance with statewide standards for service;
6) All residents of rural Pennsylvania who are disabled or otherwise suffer from causes reducing their physical ability to use conventional vehicles should have access to specially designed vehicles which will provide them with mobility; and
7) All residents of rural Pennsylvania should have access to a round-the-clock comprehensive transportation information system that would provide information on transportation service and fares within the Commonwealth.

As a result of the Rural Transportation Task Force report, Governor Shapp issued, in August, 1974, an Executive Order which outlined the roles that the various state departments were to play in the Commonwealth's continuing participation in rural transportation activities. This Executive Order charged the Pennsylvania Department of Agriculture with the chief responsibility for rural transportation activities. It also directed that all state departments would coordinate and cooperate with the Department of Agriculture in undertaking any actions which might affect rural transportation. The Executive Order also mandated that the Pennsylvania Department of Transportation undertake a rural transportation planning process that would build upon the data and information gathered during the course of the development of the Governor's Rural Transportation Task Force report.

Subsequent to the issuance of this order, the Department of Agriculture formed an interdepartmental committee whose membership was composed of the principal state departments with programs affecting rural transportation. It also included representation from other interested parties such as the Pennsylvania Taxi and Paratransit Association, the Pennsylvania Bus Association and regional planning commissions throughout the state. The Department of Agriculture also proceeded to step up its technical assistance to local areas who wished to implement rural transportation systems. The Department of Transportation developed rural transportation planning guidelines and contracted with the regional planning agencies in the Commonwealth's ten uniform planning regions to conduct rural transportation planning activities. The Department of Agriculture also filed an application for a demonstration grant with the Federal Highway Administration under the terms of Section 147 of the 1973 Federal Aid Highway Act and also continued its rural demonstration project.

The next two years saw a great deal of activity in rural transportation. The rural transportation planning process generated much interest among local agencies and governments causing them to examine their own rural transportation needs and solutions which might be implemented to meet those needs. The Department of Agriculture refined its demonstration project and proceeded to hire regional coordinators who could provide technical assistance to local groups wishing to start their own transportation systems. The private sector became especially interested in the rural transportation question. The Pennsylvania Taxicab and Paratransit Association in particular provided a great deal of information to both the state agencies and the regional planning

commissions about the type of services that their members might offer.

Steps were taken in February, 1976, to deal with a key problem plaguing most rural transportation projects, that is the lack of an adequate reliable funding basis. On February 11, 1976, Governor Shapp signed into law the "Pennsylvania Rural and Intercity Common Carrier Surface Transportation Assistance Act." Known as Act 10 of 1976, this law established a state rural and intercity financial assistance program which closely parallels the State assistance programs which had been in effect in urban areas for many years. Included in this legislation is authorization to deal with not only local passenger transportation needs, but also intercity bus service, intercity passenger rail service and intercity freight service. The program authorizations include: Assistance for capital purchases, assistance to cover operating deficits as well as funds for advertising and promotion, research and demonstration and planning assistance. When the program is fully operational and is properly funded it should go a long way toward solving the financial problems of general purpose rural transportation systems.

Looking to the future of rural transportation in Pennsylvania, it is a bright one. Much has been learned in the past four years of state involvement. Among the important lessons learned is the need to incorporate existing resources and existing facilities where possible into rural transportation systems. In this regard a great effort and great emphasis is currently being placed on involving private sector transportation service providers. The first round of rural transportation plans is nearing completion and it is anticipated that many of these plans will be implemented in the coming years.

For the foreseeable future it does not appear that the State will be operating any rural demonstration projects. Rather the State will continue to provide both financial and technical assistance to allow substate regions and local communities to operate their own rural transportation systems. The Department of Transportation will continue to sponsor the continuing phase of the rural transportation planning process. In addition, the Governor's Office is offering new leadership to encourage state agencies to coordinate their rural transportation activities and to maximize the usage of limited state dollars for transportation. Emphasis is being placed upon the coordination and integration of the transportation components of social service programs. It is hoped by doing this that cost of such services can be minimized and that a greater number of persons can benefit from the State's transportation dollar expenditure.

# Discussion

MR. WALTER WILLS (Southern Illinois University): My question is related to alternatives to Locks and Dam 26 on the Mississippi. Given the quantity of grain moving through there, what is the possibility that the railroad system over the immediate future can handle that much additional volume? We are talking about a fairly large quantity of grain.

DR. BUNKER: I think that is directed to me. Not very likely, for a short answer. We did some analysis of arrivals of grain at New Orleans. Eighty-three percent arrived by barge. The rails could double or triple or quadruple their traffic and still not make that big a dent in the barge traffic so it is very unlikely, in the short term at least, that railroads can handle that additional traffic.

MR. CLYDE G. WELLER (Forest Service): If you look at the net benefits or costs to the average taxpayer associated with adding user fees to the waterways, the taxpayer will pay less in taxes but more in prices of goods because the fees will probably be passed on to him. The only additional cost overall will be administration of the fee collection process. Is that the way you view it?

DR. BUNKER: Yes, we will pay for the waterways one way or another. I guess the question to which I didn't talk is, what are the distributional effects. Currently, of course, taxpayers subsidize shippers and consumers.

I will go one step further. When you are talking about the Mississippi River system, one of the major consumers of the grains transported on the Mississippi is foreigners and so we may have U.S. taxpayers indirectly subsidizing foreign consumers.

DR. SEAVER: Could I interject a point here? If your number one priority is to save energy, then you may come out with a different answer as to whether or not you ought to put on user charges, since it seems obvious that waterway transportation is relatively energy efficient. If you put the waterways out of business, are you not then going to have to use more energy to move that same amount of traffic?

MR. PAUL S. JONES (Georgia Tech): I would like to address this to Dr. Bunker. In your analysis did you assume that the user charges would be added to the water transportation rates and that the other transportation rates for competing services would remain constant?

DR. BUNKER: Yes.

MR. JONES: Is there a possibility that the water carriers would absorb all or part of the user charge and therefore cause your results to be a little bit different?

DR. BUNKER: Yes.

MR. JONES: Thank you.

DR. SEAVER: How likely do you think it is that that is going to happen?

DR. BUNKER: Well, I think the impact is very small and therefore I didn't go into that question in terms of rerunning the model or anything of that sort. I guess a more important issue, will the railroads change their rates in response to increases in barge rates as they add on these user charges? I suspect that would have a greater impact. Again I did not look at that.

MR. JAMES W. BUKY (American Commercial Barge Line): We don't plan to absorb the charges at all. In fact, our contracts for years have stated that they would all be passed on.

DR. JAMES C. NELSON (Washington State University): On this matter of waterway user charges, do I understand the implication is that these charges should not be passed on? Resources that are scarce are used each year to dredge the waterways. These are capital resources that are used to build locks and dams and they are scarce and they have other uses.

Furthermore, the problem is not just how much is hauled on the waterways. It is a problem also of an efficient division of traffic and function between rails and water, and pricing is a key element in achieving this.

Furthermore, the question comes up, if user charges were put on the Mississippi only, they would raise the cost very little. Is there an implication that system-wide charges could discourage the shipping of grain on rivers where it is cheaper than other modes of transport? It is my impression that with specific segment charges much of that shipping would go on just the same and any waterway which would be closed doesn't haul much traffic, anyhow, and wouldn't be very important to the whole situation. Would you like to comment on this?

DR. BUNKER: I think I agree with that. I guess that was my point, that there is a distributional effect, depending upon which policy is selected to recover the expenditures. The data I showed only represented operation and maintenance. That data is a little bit old and we are updating them. The point was that some rivers could be shut down. The resource consumption is much greater than what the price would indicate that we are currently paying. Essentially what it means is that prices in the market have given us some erroneous signals to follow, and the costs on some waterways are such that probably we should not be using those.

I don't think I answered the question.

DR. NELSON: I think you did. I would just like to specify. If the barge lines that use certain poorly utilized, maybe poorly located waterways, cannot pay at least the additional costs each season—not the fixed costs; I am not talking about past costs, I am talking about future costs—if they can't pay those, then I don't see that society loses by shutting them down. It is the same thing as shutting down the branch line on the railway when there is no more traffic by rail. It is the same thing as shutting down the Northern Pacific passenger service from Spokane to Lewiston, Idaho, when no one used it any more. If it is economic in one case, I ask the question, isn't it equally economic in a case where there is public investment involved?

DR. SEAVER: I would like to comment on that just a minute. It depends upon what it is that you have got as a priority, I think. If you want to save fuel, Mr. Nelson, you aren't going to shut down the waterways. I think it is that simple.

DR. BUNKER: While the mike is going over, I guess I will make one comment. Energy consumption is normally expressed in terms of ton mile figures and ton miles by barge are normally not the same as ton miles by rail or ton miles by truck because of differences in circuity.

MR. WAYNE C. THOMAS (University of Alaska): My impression is that the price of energy will influence how it is allocated and I would rather see the price of energy influence the mode of transportation more than by government edict on uses made of energy, so I would go along with Dr. Nelson on that particular point. In other words, I disagree with you, Dr. Seaver.

DR. SEAVER: Well, Dr. Nelson is talking about pricing. Sure, I assume that we are going to let the price of oil allocate supply. The question is whether or not you are going to have some additional charges with respect to water. That is the question. We aren't talking about the fact that the barges are going to have to pay more for fuel, the railroads are going to have to pay more for fuel and the trucks are going to have to pay more for fuel.

DR. NELSON: Well, I agree with you that energy conservation is a very serious problem. There are some people who think it is overdrawn and not as serious as others make it. The question is whether it is reasonable to recover future costs in user fees? I think it is. The main problem has to do with the main routes where the large volume is. If you are going to save much fuel through use of the waterways, you have to do it on the Mississippi and no one is likely to propose closing down the Mississippi with user charges.

MR. WES R. KRIEBEL (Pennsylvania State University): I would like to address this to Mr. Bruton. Last year a statement on transportation policy was issued from the Secretary's office and I am interested in how this statement came about and

what is the likely next step with the new Congress, as you see it.

MR. BRUTON: I am not very sure how that statement came about. It was done pretty much up in the Secretary's immediate office, and we didn't have much to do with it. Secretary Coleman felt very strongly that he should get a national transportation policy statement out and he did it pretty much himself. My office wasn't in operation when that statement was being prepared, so it has very little in it on rural policy. The Secretary has asked me to prepare an addendum to that, which will be a rural transportation policy statement. I am working on it now, but I don't know what will happen with the change in administration.

MR. BERNARD F. BYRNE (West Virginia University): I want to direct a question to Mr. Berg. The principal social cost that you discussed in terms of coal transportation was deterioration of pavements, due to overloaded coal trucks. Another social cost that perhaps you might want to consider is the very slow speed of movement of coal trucks over the tortuous geometrics of Appalachian highways. If you have been caught behind a coal truck, you know what I mean. I would like to hear some comments from you on the measurement of these sorts of social costs, just the very slow movement of both people and coal over the very poor highways.

MR. BERG: I agree that there are certainly a lot of other costs that have to be considered than what I mentioned. Certainly the safety aspects of having large trucks going at very slow speeds over winding roads is a real cost. We will consider that.

As far as the cost of hauling coal slower rather than faster, I don't know that that is necessarily an external cost. I think that is part of the private cost that should be reflected in the cost of coal.

MR. ALAN E. FINDER (Council of State Governments): Mr. Berg, I was interested in your data about Kentucky. Being a Kentucky resident, I can testify to the deterioration of the roads. I was interested when you said that you were asking the states to estimate their highway needs based upon energy production. Have you instructed them to assume that the modal share of trucks will remain constant or have you given them no guidelines on that?

MR. BERG: We have asked them to make estimates of what the modal shares are and to document their estimates.

MR. RICHARD J. MIKES (Ruan Transport Corporation): I would like to know how overloaded those two-thirds of trucks moving on Kentucky highways are. You indicated that there were tandem axle loads of 48,000 to 60,000 pounds. I would like to know also if there have been any studies done relating to measurement devices at the loading sites for these coal trucks. Is it deliberate overloading or is it a function of not having facilities?

MR. BERG: I can't say what is the cause of the overloads. Certainly on many of the local roads measuring devices just aren't there. Some states are beginning to use more mobile types of measuring instruments to pick up the overloads to a greater extent.

As far as the data on overloads, the two-thirds of the trucks that were overloaded were not necessarily all loaded to the 48,000 to 60,000 pounds per tandem axle. I don't know precisely how extensive the overloading is at this time. That is one of the things we are looking into in this study.

MR. MIKES: I am not referring to state enforcement of weight laws through scales when I refer to measurement devices. I am referring to proper loading facilities at mine sites. In other words, you could have two-thirds of the trucks overloaded by 1,000 pounds or so on the basis of guessing on the part of the coal loaders.

MR. BERG: There are tolerances allowed. Again, the extent of overload is not fully known. From the data I have seen, I would say that a substantial number of those trucks were overloaded beyond the tolerances that are legally allowed.

MR. LLOYD C. HALVORSON (Cooperative State Research Service): I want to ask Mr. Berg this question. What is the economics of requiring smaller loads versus building the highways to higher standards to accommodate these large trucks in those areas that will haul a lot of coal?

MR. BERG: We don't have much in the way of research results at this time. That is certainly one of the key things that we will attempt to quantify. From some discussions I have had with people at the University of Kentucky, their feeling is that reducing the size of coal loads would not substantially affect the coal industry. It might raise costs a little. My feeling is that it might be cheaper to reduce the loads rather than to beef up the highway standards just to service coal trucks.

MR. MORRIS H. TAYLOR (Utah State University): A combination of products that provides round-trip movements for motor carriers could give you quite different conclusions on the economics of motor carrier transportation. Does this concern you?

MR. BERG: I agree that backhauling is a very relevant consideration. We are concentrating primarily on coal. If that aspect is not being considered in our study at present, I certainly hope that we can broaden our analysis.

DR. SEAVER: I am sorry to close this discussion of coal transport, but I wish to ask a question of Ken Brewer. It seems to me that your conclusion was that there isn't going to be any real shift in the types of fuel used by transportation or in the modes used in agricultural areas. We are going to be dependent upon oil, is that really what you are saying?

DR. BREWER: Yes, in terms of the things that we have dealt with. We have gone into psychometric

scaling in terms of preferences on issues with which people are faced. My personal feeling is modal shares won't shift very much until we get some sort of crisis. The recent change in railroad regulation apparently was brought on largely by the collapse of the Penn Central system. If there is a catastrophic event we then may do something.

MR. ROBERT J. TOSTERUD (Upper Great Plains Transportation Institute): Mr. Rupprecht, you provided us with some very good statistics on a problem. You identified the problem in an excellent way. I am interested in knowing, what are the solutions to rural mobility problems in the United States?

MR. RUPPRECHT: Are you talking specifically about the energy impacts, or on the more general problem of rural transportation for people?

MR. TOSTERUD: Well, I think energy is a problem certainly, or will be in the near future. I think if anything is going to bring rural people transportation problems to a head, it is likely to be energy and I would like for you to address yourself to that issue and how far down the road are we looking before people in rural areas have to give up their cars? In North Dakota we are talking of transportation of 400 million bushels of grain by small 300 to 350-bushel trucks, going from 10 to 15 miles. A rather dramatic change is potentially necessary in the grain transportation situation.

So, just let your imagination run wild for a minute and look down the road five or ten years from now.

MR. RUPPRECHT: Well, in Guatamala, there is a lot of rural public transit. The price of gasoline there recently was roughly 95 centavos per gallon. The centavo is on a par with the penny.

Basically whether we decide to keep essentially our same mobility patterns will depend on whether we wish to pay the price. Essentially what will happen in the short term is that we will reduce our consumption of other goods in order to maintain our mobility at acceptable levels. We have to realize that, in rural areas, production is an extensive land user and we are going to have to decide whether we want the people living in these areas to have some of the amenities that we have in urbanized areas. I think that we will have to make a commitment. In the long run as energy prices increase, concentration will occur in living patterns, et cetera, but these changes can't be made overnight. We are going to have to face up to the fact that certain people will be impacted more severely in the short run than are others.

MR. BRUTON: May I make one comment on that? There is one kind of solution which I think is very important for people in the country to recognize, and that is that it is going to be very hard to find energy efficient substitutes in rural areas but not so hard in urban areas. I think it is in the interest of rural people to support public transportation in urban areas and probably public transportation for long distance intercity travel. It is probably in the interest of rural areas to support the long haul shipment of freight by rail. It is in these other places that we can save energy, not in local rural areas.

# Luncheon Keynote Address
# Transportation Equity for Rural America

James W. Giltmier
Professional Staff Member, Committee
on Agriculture and Forestry, U.S. Senate

Not very long ago, the Department of Transportation asked George Washington University to do a study on rural transportation needs.

A sizeable portion of the first draft of that study concerned itself with the urbanization of America—how urbanization was an inexorable process that had been going since the nation began, and that since rural areas would always continue to decline, there was not much point in making a transportation investment there.

A transportation policy statement required under an early 1970's airport act concluded the same thing—the heaviest traffic density is on urban roads, so that's where the road investments should go.

I can't get too excited when well-meaning people reach those kinds of conclusions. Whether we like it or not, ours is an urban society—70 percent of the people live on 10 percent of the land, after all, and one way or another, transportation systems are built to serve people.

I grew up in a pretty tough neighborhood on the south side of Chicago. The neighborhood was clearly defined, and it was my home. There were sets of stores and services to provide the needs of the people of the neighborhood. There were old people who lived there who had never seen downtown Chicago, and felt no need to do so. I knew the people associated with the gangs in my neighborhood, and either ran with them, or achieved detente with them because we were all from the same identifiable place. There was a good transportation system on which I could ride all over the city for eight cents. My father never saw the need to buy a car, and I didn't learn how to drive until after I got married.

That's one kind of urban living, but it's a kind that is virtually gone, except in the ghetto. Gone with it are the mom and pop grocery store, neighborhood churches and the sense of identity with a place.

Chicago retains some of its neighborhood characteristics—I believe, because railroad tracks crisscrossing throughout the city have defied efforts of the traffic planners to make the city a metro-mass. Continued ethnic identification and the fact that the city is built on a grid, with major thoroughfares every half mile are also major contributing factors.

My point is this:

Someone once said that government cannot do *one* thing—that in taking a major single action, a ripple effect is started, and in many respects for every government action there is an equal overreaction some place else in the society other than the original point of contact that the government was trying to reach.

The urbanization of America, and the subsequent breakdown of the neighborhoods has caused a syndrome that I like to call metro-think. We don't know what to do about our core cities anymore. They are economic, governmental and social disaster areas; Government policy and racial factors have created adjacent urban areas to the cities which one writer once called slurbs.

Attendant with the economic migration from the central cities, the planners began to think on the grand metro-scale.

Although governmental action has contributed to urban sprawl the process is mainly a function of the free market. And as we all know, if we let the market alone, it will produce things that are economically efficient.

**Jim Giltmier focuses in on "metro-think"**

Oddly, urban sprawl wasn't efficient at all. I live in Fairfax County, Virginia, which is closing schools in the northern part of the county and trying to get bond issues passed to build new ones as the population moves south. And, those of you who have to face a metro rush hour twice a day understand the waste of that in terms of lost energy and emotional distress.

Some of my friends at the Department of Transportation have been telling me for years that transportation systems don't create development. But as one gazes at the circumferential highways built around metro areas in order to by-pass congested urban areas, you see development and incredible traffic problems. In Washington there is even talk about building still another beltway several miles outside the present one.

I do not mean to point the finger here at urban or traffic planners and say this is all their fault. Instead I mean to say that our metro society has become a madhouse of waste and misdirection. But it has pervaded the thinking of people who plan retail stores, advertising campaigns, housing developments and even television network scheduling.

Aside from the fact that because of limited energy supplies the chickens will one day come home to roost in a terrible way, metro-think is so pervasive that we seem to have lost sight of the essential interrelationships between rural and urban America. We don't think about it much, but no one really believes that we can have balanced national growth; that we can have a national transportation policy; that our society will ever be anything but a grand series of metro-rings Balkanized along the coasts and the Great Lakes.

And maybe that's a realistic way to think. I don't know.

I do know that's not what Americans want. I won't cite the polls that show our people want to live in rural America. I believe the results are partly phoney anyway.

But the people who put programs on television have to have a pretty good idea of what the people want. Heads of television network presidents roll when there are too many mistakes. And I would simply point out to you that Archie Bunker and Laverne and Shirley live in neighborhoods. So do Sanford and Son and Chico and the man.

If you were to put the bucolic sweetness of Little House on the Prairie and the Waltons into a metro setting the programs would be laughed off the air. We are on a grand nostalgia kick, and it's wierd, because we are nostalgic for a time when my mother had to add water to the milk to make it go around, and for a time when she sent me to the store for ten ration points worth of bologna. It seems to me that we aren't nostalgic for what I think of as the bad old days, but for a time when our patterns of living cemented rather than destroyed family and neighborhood relationships. Isn't it sad that one of the Presidential candidates felt it necessary to set up a special committee on the American family?

But that wasn't just a political ploy. In some of our cities today there are more illegitimate children born than those born in wedlock. More than half of the married women in America find it necessary to work outside the home.

O.K.! What does all of this have to do with equity in rural transportation?

Plenty.

When I grew up in Chicago, every kid in my neighborhood had some rural point of reference. They had either lived in the country or they knew someone who did. What's more, every school child in town was taken to the Board of Trade so that it could be demonstrated to them how important the farmer was to the "Hog Butcher of the World."

Now I think metro-think has changed us all, including the transportation planners. Just as our interstate highways are fenced off from the surrounding countryside, I think we have mentally fenced off rural America from our transportation policy planning, largely because the metro problems are so huge.

And there is an added dimension to this. Even though we have a Department of Transportation, there is too much evidence that road planners, railroad planners, waterway planners and airline planners don't talk to one another. There is evidence that rate planners at ICC don't correlate rail rates with truck rates and likely barge rates.

From the standpoint of national security; from the standpoint of our economy; from the standpoint of our energy supply; and from the standpoint of the nation's general welfare we are like little children playing with matches.

Rural America is not the Waltons. It is a food factory. It is a wood products factory. It is a coal and mineral factory.

The factory is supported by thousands of small towns which serve as the lubrication to keep the factory running.

We don't need new towns. We need to keep the old ones viable.

It is dramatic, but it is also true to say that without this rural factory, running with full shifts to produce the products of the land, America is out of business.

The bulk commodities produced in isolated rural America are what make metro-America possible.

The people who run the rural factory know this, and they also know that a factory isn't much good unless you can move the product.

Therefore, when transportation planners talk about dropping tens of thousands of miles from the Federal aid highway system, and dropping as much as a third of the rail lines, the people in the factory get nervous. They get especially nervous when there is no evidence that there is any correlation between the virtual abandonment of the roads and the actual abandonment of the rail bed.

Transportation planners cannot do *one* thing. Their transportation decisions based solely on the economics of a single mode of transportation have many impacts outside of the area of transportation itself. The Big John hopper car caused a major shift in the location of the milling industry in this country. Unit trains and abandonment decisions in the works are going to close hundreds of small, private and cooperative grain elevators.

It may be difficult to justify light density lines into certain towns—lines that can only carry box cars at slow speeds. But if the local elevator's only transportation alternative is a road that can't handle a 60,000 pound truck, it's out of business.

The handful of huge private grain companies understand what is happening, and they are constructing new elevators on railroad main lines, and if possible in locations where there is more than one transportation option. And while the Bank for Cooperatives is trying to help its small elevators to pool their efforts to build main line terminals, the effort is too little and too late in most cases.

It seems to me that this gets back to the question the Farm Foundation so wisely raised of who shall own American agriculture?

In addition to the actions to modify formulas for distribution of highway trust funds, and to reassess the trackage of the Class I railroads, there are other problems that face the rural transportation system.

There has been a more rapid inflation in maintenance and construction costs than in tax revenues available to state, local and Federal agencies for highway use.

Over the 20 years that we have concentrated our attention on the Interstate system, our secondary roads have been going to hell in a handbasket.

The American Farm Bureau Federation's Transportation Committee did a generally outstanding job in its report on transportation and agriculture in September of 1975—outlining rural concerns about the deteriorating rural transportation system. The report states that by 1980 the movement of agricultural commodities is expected to reach 428 million tons, or about 21 percent over the average for 1971–72.

If we are to shift our spending for transportation in a major way to urban mass transportation systems, how will the rural system, which is already in severe distress be able to get the food, fiber, wood energy and mineral products to the people of metro-America in a timely manner? How do we meet our $22 billion annually in overseas food commitments so important to our balance of trade? How do we move the phosphates from Florida and the potash from Canada essential to high food productivity to the fields of the corn belt? What is to happen to American industry that is moving to rural America because of the high urban plant site costs?

Clearly the people of rural America are concerned with the cost, quality and availability of transport services. These people are totally dependent on the automobile for personal transit. By and large there are no transit options, which means that rural people are deprived of medical and other services which the folks of metro-central can take for granted.

But what those imbued with the metro-think syndrome forget is that persons and enterprises within metro-central are also heavily dependent on the efficiency and costs of rural transport services, if current metro-lifestyles are to be maintained. Therefore, rural transportation must be addressed at one with the nation's transportation problem.

Having said that, what do we do?

My answer to you is, I don't know. The Committee on Agriculture and Forestry has no jurisdiction over transportation, but we were concerned with what was happening to the rural system. We are not against well thought out rail abandonment. We are not against dropping mileage from the Federal aid highway system, as long as there is an appropriation for off-system roads, designated for secondary roads. We don't mind if there are large sums of money spent on urban mass transit systems if some attention is given to people isolated in rural America who can't get to medical and other services because dad has the car 50 miles away at work. Most rural Americans are not farmers, at all.

It's pretty common for those of us who are concerned about the rural situation to call for a national transportation policy. I suspect that's easier to say than to do, given the fact that we have transportation policy agencies running out our ears in Washington, plus a myriad of state regulations.

O.K. then, how about regulatory reform? That's not so easy when the regulated don't want to be deregulated, as President Ford has learned.

Governor Ned Breathitt of the Southern Railroad seems to think that the route to an integrated transportation policy is to let carriers like Southern become surface transportation companies, hauling goods by whatever mode is most economical. In other words, Breathitt would like Southern to be able to operate barges as well as trucks and trains.

That has a lot of gut appeal at first blush, but then questions of anti-trust, pushing small carriers out of business and the possibilities for non-competitive rate-fixing come to the fore.

The most obvious short-term appeal for us rural advocates of such a plan would be that maybe we could get Lock and Dam 26 repaired if the railroads were in the barge business.

On the shortest term, I would like to see some assurances that DOT is prepared to correlate its highway and rail abandonment work, and then coordinate with USDA.

The Transportation Subcommittee of USDA's National Rural Development Committee has made some recommendations for the Secretary of Agriculture which bear some attention.

The report says USDA should obtain the nearly completed bridge condition study, and as necessary,

request tabulation of underlying data for identification of the magnitude of the problem on rural roads as they may affect rural development.

Secondly, the Committee urges the Secretary to sponsor research which will investigate the economic effects on the rural economy of various road construction and maintenance standards for low-volume access roads and which will develop procedures for analyzing alternatives in operational situations. In other words, what is the value of different levels of access capability?

Third, the report calls for an inventory of road standard criteria for rural roads by those agencies now building low volume roads, such as the Forest Service.

It calls for a study on effects of various levels of Federal financing for rural roads on rural development.

And, it calls for appointment of the Secretary of Agriculture to the National Transportation Policy Study Committee—and why not? Nearly 23 percent of the freight hauled by the railroads alone is related to agriculture in some way?

Finally, the report calls for an advocacy role by USDA to the Congress and the other Executive Agencies on behalf of decent rural transportation.

The Farm Bureau made a sensible suggestion in its report, calling for multi-modal joint freight rates, which is probably a more acceptable version of the Breathitt plan.

As I said, we are not transportation experts. Frankly, we are very uncomfortable with this complicated field. But let me quote to you from a report our Committee did a couple of years ago to explain to you why I am here:

"The recent crisis in transporting grain and soybeans, the general decline in railroad facilities and service and the mobility problems of rural people have all caused concern that the rural transport system is in serious trouble, and that transportation problems will prevent the full use of agricultural resources and inhibit rural development."

I have been impressed with the quality of the program which has been put together here this week. But I wonder if the fact that you are all here means that you are already well motivated to do something, and that the message isn't getting through to the right people?

We may never know the answer to that question.

But for those of us who are advocates for rural America, and don't know a hot box from a demurrage rate, the question remains, how do we get through the metro-think when it comes to transportation policy? How do we cut through the scholarly research, the rate litigation, the work rules, and intermodal bickering to deliver the bounty of the American countryside to metro-central?

How do we provide equity for rural America?

**A. D. Seale (Chairman of Keynote Session) introduced Jim Giltmier—others in view: Ralph Avery, Nate Finkelstein, Roland Robinson and Alan Finder**

# Discussion

MR. GILTMIER: I am open for questions, but don't ask me about the likelihood of transportation legislation passing in Congress because we don't have any jurisdiction over it.

MR. NATHAN I. FINKELSTEIN (Office of Public Counsel): There has been a lot of talk here by other speakers as well as the speaker today about the need for interplay between transportation and agriculture. There has also been an indication that the Committee on Agriculture and Forestry does not have expertise in transportation.

First, a comment and then a question. It seems to me that there should be more interplay at the Congressional level between the needs of agricultural America and the transportation needs. I think this was brought out in recent hearings held by my office on a report designating rail lines throughout the United States as they are essential to the American transportation system. One of the things that became obvious is that the light density rural lines were at the bottom of the priority list. We had witnesses across the country testify that there should be a reconsideration of that priority.

My question is what, if anything, is the interplay between the committees and if there is none, why that situation, can it be rectified.

MR. GILTMIER: There is virtually none. I hope that I did not infer by my remarks that all the problems are in the executive branch. Transportation responsibilities in the Senate are divided between the Commerce Committee and the Public Works Committee. I think there are some reorganizations about to take place in Congress but essentially the way the system works is each committee protects its own jurisdiction. So, in reality I think the reason rural transportation is usually an after-thought is because the magnitude of our metro problems is so great and so costly.

I don't know the answer to your question.

MS. INEZ SLETTA (Department of Transportation): As a follow-up hopefully to some coverage on this issue of coordination between DOT and Agriculture, I think the initial program between the two departments and various sponsors was conducted in Chicago last year. Coordination has increased for this conference, and we have additional representation at this session. The next step might be to have HUD, DOT, and USDA sponsor the next one, because HUD and USDA too are actively involved in joint rural programs, in fact, the latest one being signed I believe two weeks ago.

In the earlier part of your speech you made reference to urban and rural transportation planners and some of the constraints on them. I think two things to which we should make reference are the constraints put on the planners by real estate developers, i.e., speculators, and the political pressures that constrain planners no matter what we might do, but that doesn't mean we can't give it a good concerted effort.

MR. GILTMIER: I think it is wonderful that the dialogue is opening between the Department of Agriculture and the Department of Transportation but I think there are opportunities to do even better things without even passing any new laws. There is a marvelous research system in place in the land grant universities, at ERS and ARS, and I really think that instead of frittering bucks to do silly things, that DOT ought to look at that resource and take advantage of it.

If I were going to spend a research buck tomorrow, I would have Phil Baumel go back to the very areas that he surveyed in Iowa and have him look and see what the conditions of those roads and bridges are that are going to be alternatives to those rail lines that may close down. We don't know the answers. Even the state highway departments don't know what the condition of the rural road system is.

MR. WILBUR WILLIAMS (Department of Transportation, Office of University Research): I guess I have to say something about what is going on in the Office of University Research now.

About a year ago the Office of University Research started a program to try to get minority colleges interested in transportation research. Our payoff will come on the first of December when we start getting in proposals from minority colleges that have traditionally been left out. These colleges located in rural areas are really into the problem.

MR. GILTMIER: Good. We have wonderful, competent economists and people with other skills in the land grants, the 1890 institutions and at Tuskegee.

I might say, though, in respect to the George Washington contract, I said that government cannot do one thing. Because of the fact that a guy who decided that rural areas weren't worth making investments in did the George Washington study, he then gained some status in Washington and then when Senator Talmadge went to the Office of Technology Assessment and asked them to do a study on how telecommunications could be used to improve the quality of living in rural areas, through medical and various other things, they hired that person, and he spent a year reproving what he had already said in the George Washington study. So, by placing that contract, DOT did more than one thing. It caused the waste of another quarter of a million bucks on another useless research paper.

This is why Congressman Alexander yesterday was somewhat ambivalent about research. He wants mission-oriented research that has some reasonable anticipation that it is going to have some payoff.

Federal resources are dwindling. We have had three successive tax cuts. More and more the federal budget goes into fixed costs that nobody can do anything about and less and less goes into programs.

DR. JOHN O. GERALD (Economic Research Service): Mr. Giltmier, we got into a brief discussion this morning about short term research versus long term research. My office has had a fair amount of short term research done at the request of your office and others over the last couple of years. I would appreciate some remarks by you about the relative costs and benefits of agricultural economists getting more into the short run type of research that people on the Hill and in the state legislatures and the governors' offices and so forth require that economists may be well equipped to provide.

MR. GILTMIER: I think there is certainly an emphasis in Washington now on short term mission oriented research just because people are very nervous about $50 billion deficits. But, on the other hand, I think that, unless the agricultural economists are brought into play, both in the land grant universities and in ERS, we are misusing or not using a very valuable resource.

We have two major problems in rural America. Non-farm rural people are not organized and represented by any lobby in the city of Washington. The other problem is that insofar as the commodity interests are concerned, generally they have not yet come to see that they have a community of interest in rural transportation. When you go out to talk to the Georgia poultrymen about transportation problems, they only want to know how fast they can get those broilers to New York. They are not interested in grain shipments, except insofar as the grain doesn't get to them on time.

I think that unless the land grants and the ERS people are able to pull together the viewpoints and needs of these various rural interests insofar as transportation is concerned, we will be losing a good bet. I would also say that we are losing a good bet, anyway, because despite the transportation research that has been done by agriculture, we have concentrated so much on moving the major raw commodities, there has been very little done in regard to moving processed foods.

When we quietly, mentally abandoned the Penn Central system, nobody stopped to consider that over 20 percent of the processed food in America rides on the Penn Central.

This is why I really want DOT to think about this research capability that is out there, both in the USDA and in the land grants and in the 1890 land grants too.

MR. EDWARD C. SULLIVAN (University of California): We haven't really talked much about highway financing in this symposium and one could make a very good case that the demise and deterioration of the rural secondary road system, the rotting away of all those bridges out there, is very closely tied to the nature of highway financing, that is, the gas tax.

I was wondering if you see any changes in thinking on this matter in Congress and if you see any hope for any kind of rural-urban area alliance for rethinking the whole highway financing structure in the United States.

MR. GILTMIER: No, I sure don't. We bleeding hearts for rural America aren't on any mode's side. We just want the service to be there when we need it. I don't know how you deal with the problem of highway financing, but I do know that the State of Indiana used to have the best rural road network in the United States and now it is gone. The reason that it has gone is because the Feds were holding up this 90-10 Interstate package over here and saying if you want to build other rural roads, you have got to build 50-50. So every state I know anything about went out and built 90-10 roads and the other rural roads went begging.

Now everybody is saying, "Well, we have got to take a little money and put it in the urban mass transit—$6 billion." All of my rural friends here in this room have been so nervous about asking for rural subsidies. Well, we are going to buy a $6 billion subway system in the city of Washington that is going to take only about 2 percent of the traffic off the streets. If that isn't a subsidy, I don't know what is.

I think that the rural interests will continue to be very protective of the highway trust fund but would not be adverse to increasing the gas tax if designated as funding for secondary roads.

MR. B. G. BULLARD (Federal Highway Administration): I don't have a question but I would just like to make a couple of comments. First, I think it is nonsense to say that the Federal Highway Administration is anti-rural. I don't think that is true.

MR. GILTMIER: Oh, I didn't say that, because Norbert Tiemann is one of the best rural highway men in the country.

MR. BULLARD: That is true. I don't have the facts with me but I think it is true that we still put the bulk of our money in rural areas. Most of this money is, of course, going on the linehaul routes, the interstate and the primary system.

Now on the realignment of the federal aid system, I did the regulations on that. I don't think that regulation is pro-urban or pro-rural. It simply tries to do what the Congress passed in the legislation and if anything we tried to be as liberal as we could in the reduction of the secondary highway system. If, in fact, we had interpreted the legislation literally, we probably would have ended up cutting back the federal aid secondary system by about 60 percent. Actually we didn't do that and I think it is going to come in at something like about 40 percent reduction.

Now, why did we reduce the federal aid secondary system? It was up to about 650,000 miles and it had been growing for years and years. We had enough money, revenues, annually to probably handle the

needs on less than 100,000 miles, so our idea was, let's try and concentrate our money on the most important rural collector routes. That is the basic reason we did that. The issue really is not cutting back on the mileage. It is money. That's the issue.

MR. GILTMIER: That's right. You know, as I said in the prepared remarks, I don't mind if you drop all those miles off the federal aid highway system if you give Gene McCord here the flexibility to where he can put secondary road money where the state determines its priorities are. The only danger in that is in states like California and New York where urban interests are going to put real pressure on to get those dollars into urban areas.

But you are absolutely right. I don't have any bias against the Federal Highway Administration.

MR. BULLARD: I guess the point I wanted to make is, I think that we are trying to hang an issue on the cutback in the federal aid secondary system. I think that really is not the issue. It is money. Take the State of Arkansas, for example, where Congressman Alexander is from. They cut back their federal aid secondary system rather substantially when in fact they could have added, I think it was another 4,000 miles. They elected not to do so, and for one simple reason. They were trying to maximize their federal dollars, as they should do, and by cutting off the other 4,000 miles on the secondary system they were able to increase their apportionment of off-system funds, which supports my point that it is not the cutback in the mileage, it is the money.

MR. GILTMIER: I agree with you. You know in Dawson County, Georgia, it used to be that if you wanted the county commissioner you had to get in your car and start out on the gravel roads, the county roads all through the county, because he was on the grader. He saw that as being his chief job as the chief executive of Dawson County. I have just got to tell you that this economic situation is going to put a whole lot more rural highway commissioners out there on the grader.

MR. LEONARD A. POTH (University of South Dakota, Business Research Bureau): Have you got time for one more thought? You touched a nerve end about using the capabilities we have available. Three years ago we took a comprehensive proposal into DOT, proposing to study the rail lines for our state, and our proposal received very favorable reviews all the way up to the top of FRA, at which point it was turned down, because we were going to produce, and I quote, "material that could be used to fight rail abandonments." John Ingram, of course, turned out to be very prophetic because our state legislature came up with the money over a period of a couple of years and we did fight three of the five rail abandonments that were proposed. We have won one and have a very good chance of winning the second, and the third hasn't started. But if they take the attitude that you are only going to produce what the administration wants to hear, I think this capability is going to go right down the flue.

MR. GILTMIER: Well, yes, you are right, but I will tell you as a rural advocate it surely doesn't make me very comfortable to be a part of the troglodyte movement insofar as transportation is concerned. I don't like fighting rail abandonments and I don't like going to war with the Highway Administration, but it seems as if nobody else is going to protect our interests if we don't and we are in a raw defensive position. We are not in a position where we can be creative and help you to solve the problem of rural transportation. Instead rural Congressmen constantly find themselves on the floor of the House or the Senate trying to fight against something that really, if they could modify it to meet rural needs, they could probably support.

MR. EUGENE L. McCORD (Georgia Department of Transportation): Jim, when are they going to start redefining the term rural development to incorporate the ability to salvage what we already have? We have been fighting various departments. We have been to the Ag Department, we have been to Commerce, HUD, everywhere, trying to maintain a semblance of ability to help local governments who do not have the funds themselves. We have bridges in Georgia that are bowing in. We can't find any funds in a category for this. Our state itself faces a decline of revenues. The Federal Highway Administration money is not even applicable for it. When will Congress rephrase the term development or enhance it to incorporate the actual needs of this nature?

MR. GILTMIER: Under the '72 Rural Development Act there is a community facility loan program that provides 5 percent loans for community facilities. Obviously roads are community facilities. It also has a loan and grant program for industrial parks and attendant roads that might be needed for them. But despite your good efforts, I am very nervous about turning that into a road program. Right now we are building hospitals and fire stations and other community infrastructural needs with that money. I am afraid if we start spending large slugs of it for roads, pretty soon we won't be doing anything else with it.

It seems to me that road construction money ought to come from the Federal Highway Administration and not from the Department of Agriculture. I know you and I are in conflict on that but I think we are going to stay that way.

DR. SEALE: Thank you, Jim. I think the discussion indicates the kind of provocative discussion you brought forth and it has been a very enjoyable one. Perhaps this conference has done one thing if nothing else. I believe we are at least thinking about better coordination and cooperation among the different agencies. However, I am not so sure that a mandate from Congress wouldn't be helpful to nudge us along our way.

**Visuals were used extensively by discussants**

# Session F: Reactions, Research Needs, Research Funding Trends

David E. Moser, *Moderator*
Associate Professor of Agricultural Economics
University of Missouri

DR. DAVID E. MOSER: This windup session is going to be an informal affair. We want you to be very much involved. This is a finalizing of your opportunity to let us know where we should go from here, so we solicit your questions and your comments.

We will ask the fellows here on the panel to make brief opening statements, giving their perspective as to how they see the conference and how they see gaps or opportunities for further development in this area of transportation research.

It seems to me that we have had a program that is a real contribution. The timing is excellent. This is a point in time at which we needed to pull back and take a look at where we are in terms of research in transportation economics and where we need to go from here. I certainly want to compliment, and I know you join me in this, the people that conceived the idea and did the planning job to put this together. Having been involved in planning and directing conferences through the years, I am especially appreciative of the way in which they made this thing go.

However, at this point what we want to do is ask, how can we do things better, not particularly in connection with the symposium itself but in terms of the state of the knowledge, the state of the research that is being done in this area, where do we need to go from here. It seems to me that our symposium program has highlighted some things that we need to take a very good look at.

One of them is the question whether we are identifying the right kinds of problems to work on, whether we are really addressing ourselves to the questions that need to be answered, and to what degree we need to reorient ourselves or rethink our approach.

There is a great tendency, I think, in the club of economists to work on the things that they want to work on and there is also a tendency for us to like to make use of all the analytical tools that we have in abundance, and sometimes we get a little exotic in the way we present things. One of the things that perhaps we need to take a look at is the information delivery on the results of our efforts.

I would like to go back beyond that, though, to the need for close coordination, for close contact with the operators, the industry people, in not only identification of the problems but in the research design and in the process of data gathering and analysis so that we have a team approach to this that makes the best use of all the resources we have. That especially applies to the industry people who can make such a contribution to our efforts.

Dave Moser opened the final session

# Panel on Reactions to State of Knowledge and Research Needs

Dr. William R. Southard, Mr. Byron L. Nupp,
Dr. Paul W. Barkley, Mr. Eugene L. McCord,
and Mr. James H. Lauth

DR. WILLIAM R. SOUTHARD (Manager, Special Projects Staff, Interstate Commerce Commission): I must make the usual disclaimer that I am not speaking for the Interstate Commerce Commission. The reactions I will express are entirely my own. My point of view, however, is a function of my research user activities. I develop and present evidence. Evidence, to have utility, must be of probative value. Accordingly, my highest priority need is for research methodologies and results which can be translated into evidence which is to the point and can successfully withstand rigorous and competent cross-examination. With these comments in mind, I will give my reactions to the symposium research papers.

Concerning methodologies, it seems that we know how to do what we knew how to do 10 years or so ago. Areas of concern have changed, to be sure. The big concentration of effort now, understandably, lies in (1) impacts of rail abandonments, and (2) deregulation. But we're still doing things the same way. We've been modeling the world and its relationships for years. We learned how to do economic feasibility studies a long time ago. Finally, our muse continues to arrive so that our *ipse dixit* assertions are as numerous as ever.

Given my point of view, certain of the above modes of operation are irrelevant. Global models, all too often grounded on overly simplistic assumptions, with incomplete objective functions, and dealing in "tendencies," really don't produce probative evidence. Similarly, pronouncements *ex cathedra* are equally deficient in respect to evidentiary standards.

I don't intend to imply that I am opposed to large-scale modeling or the informed opinion of experts. Such is certainly not the case. I am saying that, based on my highest-priority needs, such activity is not immediately helpful. To paraphrase a previous speaker, we generally know what we ought to do, the "how to do it" is the problem.

Using the term loosely, I labeled the remaining type of activity economic feasibility studies. I am very pleased to see much of your considerable talent directed toward this kind of effort. Perhaps economists owe a debt of gratitude to the "railroad problem" for getting them involved in realistic, grubby sorts of research. My former university colleagues in marketing and civil engineering departments would say, I'm sure, "Welcome aboard—it's a lot more fun." For me, I see these micro studies as a move in the right direction. They are based on relevant facts, and they present down-to-earth conclusions. The number and quality of papers reporting work of this genre was substantial. The class of work to which I refer can be illustrated by reference to a few papers. I note here that my choice of illustrative papers was dictated almost solely by a random grab at the pile of symposium notes on my hotel desk after lunch.

Due's work concerning mileage/break-even ton-mile relationships on low density rail lines is impressive. Perhaps everyone knows that if you're going to keep low density lines open, you should keep the shortest ones. Due and his people have apparently gone beyond the common knowledge approach, if such exists, and empirically demonstrated a relationship.

Cornelius' project concerning exempt agricultural product motor carriers was well designed and executed, and the results seem relevant to issues at hand. I found it refreshing that the conclusions were not generalized beyond the population under investigation.

Baumel and associates dealt in great and realistic depth with the pressing issue of rail line abandonment. This kind of activity should be of immense value to decision makers in that most controversial area.

In his presentation, Weller demonstrated an analytical tool designed to test the economic feasibility of rural (forest service) road systems. His approach and methodology represents, in my judgment, a sophisticated simplicity which economists and other social scientists would do well to emulate.

As to research needs, I think I have made my preference rather clear. I believe you should place emphasis on the analysis of problems at the micro level. Particular issues? You pick them. But, from my point of view, I urge you to select issues based on what's happening in the world—on what the day-to-day problems are.

I also urge you to work with people in other fields. In my judgment, the quality of much of the work discussed at this symposium would have been enhanced had the skills of noneconomists been

utilized. Marketing people have been researching attitudes, perceptions, expectations and the like for years. Engineers, particularly Industrial and Civil, are masters in applied economic feasibility work. In addition to the technical benefits you would receive, there is major social welfare benefit accruing from interdisciplinary work. The lesser disciplines need exposure to some couth.

A final disclaimer. My reactions to the research work was based solely on the presentations at the symposium. I reserve the right to change my mind after reading the proceedings.

DR. MOSER: I am very much in sympathy with the comments that Bill has made about the need to get with it on some practical research projects that answer real questions that are going to be needed for the decisions to be made next week and next month.

These decisions get made whether there is any information base or not.

MR. BYRON L. NUPP (Assistant Director, Office of Transportation Systems Analysis and Information, U.S. Department of Transportation): In participating in this conference, I feel I am partaking of a very great tradition of research in our American academic life, and one of the things that has always disappointed me with respect to research applications in agricultural transportation has been that it has been rather episodic. It seems as though the agricultural people are usually preoccupied with the mission of production and marketing and have turned to transportation episodically when there are severe transportation problems in the economy. And when these transportation problems either go away or are forgotten about, then emphasis lags and does not recur again until another cycle comes around.

I see that at the present time there is another of these cycles, and I have a somewhat personal interest in this because when I was a young man of 22, I was employed by the Department of Agriculture as a transportation analyst. Visualizing a very brilliant career in agricultural transportation research, I was quite disappointed a couple of years later to be taken out of the service because of severe budget cuts when that particular episode went away. The only satisfaction I have gotten since then in that regard is that when these cycle recur, I always get acquainted with a lot of new people who are coming again with the same issues and inventing the same wheel but bringing up new methodologies and very sophisticated things each time. So I have been able to follow not only the cohorts of these wonderful people but also the new methodologies that have come into use.

I think, however, that a new day has come. I think agriculture is now in this transportation research game forever. It will not go away again on a episodic basis. The main reason for this is not only the apparent resource constraints which are perhaps going to be a permanent part of the economy but also because the rural movement in our society is developing trends which are, I think, bigger than the Department of Agriculture and bigger than all of us.

And so I want to talk about some things that I think were stressed very highly in this conference, and things that perhaps the next conference could take up, and then talk about at least three general areas of concern in this rural transportation movement and comment on the kinds of papers and activities which were presented here.

This conference has been outstanding both in its conceptual and theoretical line-up. It has been outstanding in terms of the amount of practical experience that has been demonstrated on this platform, and also occasionally for some of the rap sessions that have been held about rural transportation. I have heard about some of the new research tools and theoretical formulations. There has been an occasional Doubting Thomas who perhaps believes that some of this stuff is a little too abstract and perhaps is not too practical in its application.

I would say that whenever you sit in a meeting and when the people are squabbling about whether the proper model is a regression model or a choice model, whether we are talking about distributional aspects or allocational aspects, listen very carefully because this may be the thing that will change the world tomorrow. There was a great prince of the church once who complained that the monks were squabbling and he dismissed the squabble. One of the monk's was Martin Luther and he changed history immensely as a result of this squabble. Some of the theoretical issues that you heard here may actually come back to change activities, too. I think we should follow rather the idea of Ignatius Loyola who, when he was arguing with the infidel and found that the person had the better of the argument, he went back to school for 14 more years. The strivings of that lonely man have been one of the primal foundations of our modern educational systems, along with the research tradition upon which it has been founded.

Now the three activities which this conference focused on are first, the concerns of the productive efficiency of agriculture itself and how transportation can improve that. The second one is the problem of the rural-urban balance or the balance between industry and agriculture which is coming to rural America. Agriculture probably cannot sustain the rural economy in its entirety and we do need new research activities to take care of that. The third thing is the sociological or the social aspects; if we do have a tremendous movement of people and industry toward rural America, then we have to look at the way in which the lifestyles, the social activities and the services of that particular type of community will be fostered and improved. All three of these things were stressed somewhat in this conference.

With respect to the efficiency and productivity of agriculture and how transportation can affect that, we need a lot more research and we have to look at

the kinds of research themes we want to develop in future activities and conferences. Two or three of the themes I could suggest would be, one, what is the right amount or what is the right funding for research in agricultural transportation. I happen to think that the funding is not only inadequate but it is also somewhat misapplied or there is imbalance in the way resources are expended. To some extent, the people in DOT's Transportation Systems Center and I are cooperating in developing some themes for research that hopefully will be based on some scheme for improving overall research programming in transportation.

Now in the agricultural sector and with transportation generally, I believe that we need to concentrate research on the efficiency of the whole supply system in transportation and this, of course, will bring forth some deep research on demand for transportation. I have expressed this in a paper before the Transportation Research Board. We have to concentrate research in these areas in a very specific way and not scatter our fire in terms of a large number of diverse research projects. There is a tradition in transportation for this, in the research that was done after the 1920 Transportation Act. A railroad consolidation plan was mandated by Congress which required research. Following that, the Transportation Coordinator in the 1930's did substantial research and when the 1940 Act was passed we had the research for the Board of Investigation.

All of these legislative enactments were considered by Congress to be tentative, and it was the intent of Congress at that time to base further legislation and definitive legislative pronouncements on a kind of focused and concentrated research in certain areas. I believe that the frustration of these intentions is one of the primary reasons why regulatory and investment policies for transportation have been in the wilderness for, lo, these 40 years. A concentrated and focused research effort analogous to what was envisioned by Congress in these earlier Acts is necessary to bring us out of this wilderness.

Now I want to say a word or two about the second area of my concern, which is the rural-urban balance, the balanced industrial and agricultural and service economy which could sustain a new movement toward rural America. Not very much was said about that in this conference but there is a great deal of interesting work going on that is being pushed from the political rather than the analytical side, and I think the political element which Congressman Alexander epitomized yesterday illustrates the importance of this area. One of the interesting things going on is a Kansas City to Brunswick, Georgia, corridor study, which is dedicated to this idea of rural-urban development and balance and to see what transportation technology can do to help us here.

There are a number of other proposals that are already enacted into legislation and if systematic attention is not paid to this particular rural development issue in an organized way through initiative of the federal agencies, then the political forces of the Congress and elsewhere will dictate the kinds of programs that are to be done. Already there are two or three of these in legislation which are being promoted and set forth in very specific legislative terms. This is very important work that ought to be fostered and a lot more organized research attention needs to be given to development programs.

Now the third area I want to stress here is the one that Dr. Kidder was talking about yesterday in her excellent session in the morning, and that is the quality of rural life, the sociological aspects. The rural sociological implications of these sorts of things that can be established by research have to be further developed in conferences of this kind and put forth to the academic community and to people who program research so that these kinds of issues can be researched further on an organized basis.

I would summarize by saying we need to look at the research themes, including the amount of research, the themes of research, the emphasis on whether research is to be practical or theoretical, whether it is focused or diffused as it is now. We have to look at the question of the kind of research we need for the productive efficiency of agriculture. We need to put more emphasis on the rural-urban balance or the industrial-service-agricultural mix necessary to sustain the economy for this rural movement, and we need to spend a lot more time on the values and social correlates of a new way of life in rural America.

DR. PAUL W. BARKLEY (Professor of Agricultural Economics, Washington State University): This conference has puzzled me. It was billed as a conference dealing with transportation for rural America, and as it turns out, it has been primarily a conference dealing with how to haul grain down the Mississippi River.

We missed an extremely important element of transportation when we overlooked the problem of assembly in rural areas. The assembly of grain into movable blocks is indeed a problem that is going to need attention. Mr. Baumel and others should have picked up this theme in their various comments on rail and barge transportation. The reported work has been fine, but like most pieces of economics research, most of it was designed to change the world while it hid behind the famous apology that all economists use, ceteris paribus—everything else will always be equal.

If we don't work more on things like assembly and collection, our grand studies about moving large amounts of things over long distances aren't going to do us much good. This is one area where I think transportation economists ought to do something that they have not been doing.

Secondly, it fascinated me that we spent so much time dealing with rail abandonment and neglected

the abandonment of other modes of transportation. There is nothing in the rule book that says we can't blow up bridges or take other actions to rearrange all kinds of transport schemes. A little time spent thoughtfully blowing up bridges might aid in removing any mindless fixation on the idea that we have to be able to move things and people all the time. Put another way, we don't spend enough time studying mobility avoidance—that is, just decreasing the amount of movement that has to take place.

Our research should be rearranged a bit to allow prescriptions in this area. Transportation economists need to try to find out what things can be moved, what capital fixtures can be moved, and what relocations of people can be brought about in order to eliminate the necessity—or at least reduce the necessity—of constantly having things and people chasing each other over the countryside.

Third, and moving in very discreet jumps, I am very bothered by the particularistic nature of the research reported at this conference. Transportation relies upon *systems*. There is a rail system. There is a highway system. In rural areas there is a road system. There is a bus system, and there is an air fleet system. Although this is common knowledge, only Dr. Friedlaender of MIT came to this conference with any well disciplined discussion of *a system*. The rest of us are nit-picking. We are electing to inquire into (sometimes) miniscule parts of the system and are ignoring the tremendous complexity of the system or the *network* that allows people and things to move. This is unfortunate. We have the analytic tools and in many cases we have the data to work with the whole system. The only thing that is lacking is the imagination and the courage to go ahead and put *the* system together as an object of research. This must be regarded as one of the most important neglected areas of transportation research and policy.

The next thing that seemed to be lacking in the conference is the whole problem of the relationship between transportation and area or regional development. We take for granted the fact that a place cannot develop without some form of transport. But we don't know what a 10-percent improvement in transport will mean in terms of development. Will a 20-percent improvement in transportation bring a 20-percent increase in development? Will doubling access also double economic activity? We have no idea of the relationship between either the quantity or the quality of transportation services and the amount of rural or area development that will take place. In this era when many public officials are concerned about population shifts and the development of rural areas, this theme must assume a rather high place on our research agendas.

Even in the face of all these minor objections, one theme remains clear: We as local, state, and federal employees interested in problems related to transportation must improve our capacities to talk to policymakers. This theme has come up time and again during the conference. It is not certain that policymakers are going to be able to assimilate the information in full even if we do talk to them, but we have to learn to talk to them. To do this, some of us will have to back off from our preoccupation with the journal articles that get our academic rewards for us. There may be more money in publishing a journal article but most of us should spend more time in our states' capitals, pounding on doors, explaining problems and needs to those in charge of policy formulation. In a word, we ought to quit talking to each other and begin to talk to some other people. It is much to the credit of the organizers of this particular session that they did involve some policymakers in the conference, although those who make rules and policy did not get the opportunity to stand behind the microphone very often.

All of this suggests something we can all do. We should go back to our various institutions and stop everything we are presently doing. After we quit all of that, we should put our feet on the desk and stare at the wall for no less than two weeks. I declare that to be an absolute minimum. When this time has passed, we should start talking to people and thinking out the problems. The first person to talk with is a young child, because a young child has fewer biases and is more rational than anyone else you will deal with!

Now, what are you going to talk about? The first question you want to raise is why do things and people move. Then ask the next question: do they absolutely have to move. After that, ask what arrangements need to be made so people and things can move. And finally ask, how do we aid policymakers in getting these arrangements accomplished.

After this, you call your closest professional colleagues and begin to raise questions with him. You talk with him about organizing a completely new research program. In starting fresh you understand that in the new research commitment you will have 80 percent of the useable results in hand by the time 20 percent of the alloted time and money have been spent. The last 80 percent of the time and money will be geared toward needless sophistication that is required only to satisfy professional peers rather than people who can use the information.

Now, I will raise an admonition for those of you who are policymakers. Until these steps are taken, you will continue to go to researchers and ask questions. If the researcher answers the question, one of two situations exist. Either the researcher is very, very young, or the question is very, very naive. All economics is very complex. The economics of transportation is no exception. Researchers will continue to produce partial answers to partial questions and they will continue to make mistakes. Policymakers must understand this and come to the researcher with the hope that the two, working together, can improve reality even if they cannot perfect it.

MR. EUGENE L. MCCORD (Construction Program Manager, Office of Programming, Georgia Department of Transportation): As the agribusiness community develops more plentiful harvests, it is placing an ever greater demand on the local transportation networks. It is now having to transport more tonnage over greater distances. This increased tonnage is wreaking havoc on local post roads. These post roads are normally unimproved and with bridges which can only carry the weight of normal traffic, much less a heavily loaded agri-truck. This can cause farmers to travel greater distances at increased costs to deliver their products to markets or shipping points. This is an area needing research.

The full impact of recent legislation which permits additional abandonment of existing rail facilities and the realignment of the Federal Highway Administration's secondary system has not been truly evaluated for its long range effect; but we who are involved in providing transportation systems at State levels are becoming increasingly alarmed at the lack of available funding to meet the urgent demands of neglected rural America.

The State's role has been one of attempting to solve transportation deficiencies with too little available funding. The increasing demands of the larger urban population has diverted funds from much needed rural transportation improvements. Loss of real revenue due to the energy crisis and enduring inflation has further reduced funds for maintenance and has severely crippled the potential for improvements on rural systems.

In Georgia, for example, the realignment of the federal-aid system resulted in 14 percent of those roads reverting to local governments for improvements and maintenance. In FY 1976, if you should combine the current Georgia Federal-Aid secondary and safer off-system eligibility, Georgia has actually lost $4.2 million in Federal funds as a direct result of the realignment compared to what was previously categorized as secondary.

Prior to the energy crisis, the Georgia Highway Authority had provided approximately $45 million per year for bridge and road improvements on county roads. But due to the reduced purchasing power of motor fuel tax revenues, our bonding capacity ceiling was reached and this vital source of funds was eliminated. Thus, not only has Georgia lost Federal funds, but also State funds have been curtailed.

The direct result of our budgetary constraints has been the elimination of the State passing-lane program, four-laning program, State bridge replacement program, rural road program, and the urban bond program. Many of these programs now are the responsibilities of local governments. As all of you know, local governments simply do not have the funds and capabilities to assume this responsibility. With the exception of completion of the interstate system, Georgia has been forced to reduce its Construction Work Program to contain required maintenance and improvements of higher functionally classified roads.

For the fiscal years 1974-79, it is anticipated that Georgia will have incurred approximately $400 million loss in road use funds from the official Five-Year Construction Work Program. This is a combination of losses in real motor fuel taxes and bonding capacity. In fact, during the last legislative session, the Department of Transportation had to go to the Legislature for the first time in order to obtain funds for a minimum maintenance budget.

In Georgia there are an estimated 16,000 bridges and bridge-type structures that are not on the State or Federal-Aid systems. These bridges are the responsibility of local governments. At least 25 percent of these bridges are structurally deficient for today's loads even if the structures were in good condition. But the facts are that the majority of them are structurally unsound through decay, corrosion, and other forms of deterioration.

There are as many again that are functionally obsolete. That is, they are narrow and hazardous for reasons other than strength. They have insufficient vertical clearance, bad alignment, are subject to flooding, and present other problems which contribute to poor facilities serving rural Georgia.

This brings us to the vital points needing research: Where are the funds coming from to replace the thousands of deficient off-system bridges? Where are the funds coming from to improve the roads of rural America? Where are the funds coming from to insure an adequate transportation system for the increased demands for America to feed the world?

Should we hope for special taxes on our agri-exports? Should we demand and expect higher dedicated gasoline taxes? Can we expect more latitude in using Federal funds? Will we continue to underwrite bankrupt railroad companies? Will we allow further reductions in Federal aid to our States, or do we sit back complacently and see a further deterioration of our rural transportation networks which developed this country to its current potential?

These questions must be addressed. The need is mounting daily, and simple statistics to which I could refer do not suffice. The very life blood of this country flows in our ability to feed more and more of the world's population. But if we are not able to transport the agri-products to the markets and shipping centers, of what good is increased efficiency and productivity to the farmers? None . . . . therefore, the need of rural America is apparent. It is a difficult research question to address, and only with a multitudinous effort can it be resolved.

MR. JAMES H. LAUTH (Director of the Transportation and Warehouse Division, Agricultural Marketing Service, U.S. Department of Agriculture): In thinking about my reaction to the papers and discussion at this conference, I guess my first reaction is, when am I ever going to get enough time to read all the papers that were presented here or

some of the other research that has been done in the area of transportation of agricultural commodities. That is a problem with those of us who are involved in running programs and program operations, whether we be in the public sector or in the private sector.

I would like to tell you a little bit about my perspective when making these comments with respect to research needs and my reactions. Our role at USDA is that of developing and implementing the position of the Secretary of Agriculture before the regulatory agencies and before the carriers with respect to changes in freight rate structures or in rate or service adjustments. So we do need to be in a position to determine what that position should be, what is best for farmers and also for agri-business firms in the marketing system. Research helps us in developing appropriate stances.

The second part of our job in USDA is to determine the position that the Department of Agriculture ought to take on national transportation policy issues with respect to, for example, regulation or deregulation, waterway user charges and the like. We provide input to the Department of Transportation within the Executive Branch and also to the Congress with respect to proposed legislation. That is how I am looking at the needs for research and my reaction to the presentations here.

I would like to make one general comment and then get into some areas where I think some additional research is needed or where there have been some gaps in research. The research to which I listened here, with some exceptions, has been too broad, too general, maybe in some areas too sophisticated. There is a place, of course, for econometrics or modeling but I think the thing often wrong with that is that the data are too weak. After all, you are only going to get out of those models what you put into them.

We really don't have the data that we need to make the kind of day-to-day decisions to which Bill Southard was referring or the longer-term decisions with respect to national transportation issues.

In my opinion, not only the data but some of the research should be more descriptive of how the system is operating. For example, exempt trucking is one of the major forms of carrying agricultural commodities. I don't think we really know how the exempt trucking function operates. Do the exempt truckers shift from one growing area to another growing area when there is a slack demand in one area and a peak demand in another area? Do the independent owner-operators who operate under long-term lease to certificated carriers go into the exempt trucking field when they have a slack time under lease? How many certificated carriers really operate in the exempt trucking field, or is it performed mostly by exempt truckers?

Now we have done some work in this area but there is a lot more that we need to know about the operations of these exempt truckers and other motor carrier operations. With respect to other motor carrier operations, I was listening to some of the discussion on the first day about deregulation and how it might affect rural areas, and one of the points made was that certificated carriers may not be serving rural areas today. I suspect that the carriers who really provide most of the service for the rural areas today on inbound movements are private carriers. I think that is the case but we don't have adequate evidence to prove that.

Another area, talking about data needs, I have often wondered whether it would be feasible to develop a system whereby we can get continuous flow data. It would seem to me to be useful to know on a continuous basis relative changes in traffic flow. If we could develop checkpoints along the major highways, it would be feasible to develop changes in traffic flow, where commodities originate, where commodities terminate, how they are moving, whether they are moving by private carrier or by exempt carrier or by certificated carrier. If we had this information on a continuous basis, policymakers could develop actions immediately because they would know what the problems were and where they were.

To give you some thoughts as far as additional research needs or gaps that we might have in the area of regulation, and I think Ann Friedlaender suggested this, we ought to look at what the costs of deregulation are. Or, to look at it another way, what the benefits of regulation are. I don't think that has really been looked at well enough to identify those segments of the economy that will get hurt. Then we need research to develop the costs so that they can be compared to what benefits might be achieved or what we perceive might be achieved from deregulation or partial deregulation.

As far as the agricultural exemption is concerned, I thought one of the best studies that has been done from my perspective was the livestock trucking study done in ERS and also in general the studies done by Walter Miklius and Jim Cornelius on the overall stability and performance of the exempt trucking sector. The livestock trucking study looked into the cost characteristics, the service provided and cost-rate relationships, and that was very helpful to us. Possibly the same kind of study should be done with respect to produce trucking. That is one area where we are having a lot of problems.

Another area, and this gets into some specifics, is rail performance under the Quad-R Act that was passed in 1976 that gave the railroads some flexibility with respect to rates. There is an opportunity here to do the same kind of studies that USDA did in the 1950's on fresh fruits and vegetables in the sense that there could be "before-and-after" studies. I think a study could be made of what the rail rate situation and service was prior to enactment of Quad-R and then in a couple of years look at what the railroads'

response was to the flexibility that they have gained under the law. The railroads have said, I think rightly, that they didn't have flexibility because of previous law. Now they are given it, and if you do a before-and-after study, we will know what response the railroads make and how that impacts upon the shippers.

That leads me to the question of the Quad-R Act in the area of peak demand pricing. I think some research is needed in that area and not just with respect to transportation but what effect peak demand pricing will have on the agricultural marketing system.

There is another point I want to make. Sometimes when we make these transportation studies, we look at the impact that it has on the mode of transportation and not the impact that it has on the rest of the economy, on the agricultural marketing system, and I think Jim Giltmier's talk at lunch pointed out the impact that changes in transportation or transportation policy have on the rest of the economy.

Under the Quad-R Act, there is a provision for pricing distinct services, providing ala carte service by the railroads. What impact is that going to have on transit privileges and to what extent do transit privileges impact on producers and the marketing system if there is a specific charge made for transit.

One comment on rural roads, which also is of concern to us in our area of responsibility. As Jim Giltmier said today and as Congressman Alexander pointed out, there are issues such as the opening up of the trust fund and the reduction of rural mileage in the Federal-Aid Highway System, but as was pointed out today by the Federal Highway representative, the problem is really a reduction in funds rather than mileage. The deteriorating condition of roads and bridges in areas where about three-fifths of the rural arterial collector roads are identified as deficient and the increasing abandonment of rail lines may present some real problems in the future with respect to getting farm products out of agricultural areas.

What we need to know overall is the economic effects of these conditions on agriculture—what effect will they have on farm prices, on exports, food prices and the overall agricultural marketing system. I think we need that kind of study to determine what those costs are so that decisionmakers can make some evaluation of policy choices.

Arvin Bunker did an excellent job in his paper on the waterway user charge. That is a very significant issue. I think that is an example of the kind of studies that we need. Also, Phil Baumel's study is another good example. Maybe we need more case studies rather than broader, long range studies.

I might mention one other area. That is the so-called State barriers to free movement of interstate traffic between the States. There are restrictions such as variable taxes, licensing, registration and weights. I am not sure that that is a researchable item. The main problem there, of course, is in the state legislatures. I don't know that any amount of research that you did would solve that problem.

# Discussion

MR. PAUL S. JONES (Georgia Tech): There has been some discussion this afternoon about research needs, and I think these are very appropriate. The thing that concerns me most about the research environment is the continued refinement and definition of research needs along the direction of the policy that the particular policymakers are pursuing. In other words, I see an increasingly closed book on the applicability of research for universities and other organizations. We find ourselves responding more and more frequently to work statements that are prepared by people who as often as not have a real axe to grind, and this restricts the free introduction, or rather the support of the free introduction, of ideas that might be generated outside the funding agency.

MR. LEONARD A. POTH (University of South Dakota): Several comments have been made here today that really strike home. We just came off a fracturing year of two rail abandonment hearings that lasted 11 days each, and it can be summed up on the fact that it seems we are all trying to preserve the railroads and not the farmers, as I think Mr. Lauth has stated. The research that should be done and brought out, I think, is some honest figures from the railroads.

We hired a short-line operator out of Mississippi to come up and look at the lines and reevaluate the cost of upgrading, and he estimated, and the railroads agreed before the hearing was over, that they had overestimated by about 10 times the number of ties that need to be replaced to bring the line up to a Class II. They also admitted that some of the cost figures they gave to operate the line were based on the use of a locomotive that was designed to haul 50 to 75 cars on the main line, but it was so worn out and so inefficient that they couldn't even turn it off—they let it run 24 hours a day—and the cost of operating that locomotive was part of the cost that they gave in testimony to indicate that that branch line was costing them too much money.

DR. MOSER: Your suggestion, sir, is what?

MR. POTH: That there be a more concentrated effort to get the research done on some of these

railroad costs that are being used to justify abandonment.

MR. ALAN E. FINER (Council of State Governments): Under the new regulations that were proposed by the Interstate Commerce Commission on the proceeding for the abandonment of rail lines and also in the FRA regulations governing the application for planning funds under the Quad-R Act, there is a need to inform both of these bodies on the impacts of rail abandonment and the impacts of local rail service continuation upon local communities. It is specified in the regulalations and I believe it is specified in the Quad-R Act. There is an opportunity for research in that area.

DR. SOUTHARD: I am not involved at all in that issue, but I think this gets to one of the research areas in which I would like to see professional economists who are after all technically very competent, get involved. The hearings are dominated—well, not dominated—administered by legal staff. The legal staff for the railroads, for the shippers, for whoever the parties are, tend to dominate the Hearings according to the rules of evidence, as by and large it must be. I think you people can make a great contribution by working with them and getting the economic analysis in and making sure that everybody plays the games according to accepted rules of economics or business management or what-have-you. Get involved in this kind of thing. I congratulate you, sir, for being involved in that one. I don't envy you particularly.

DR. STANLEY SEAVER (University of Connecticut): Let me first support what the gentleman from Georgia Tech just said. You are not going to get very many university research men to submit proposals on many things because you can see that there is only one side of the issue that you are supposed to take. Now an honest research man is not going to research under those circumstances.

My second point is that I am a little disturbed today that we get so many suggestions for short-term research. Let me repeat what I said this morning, that first of all economics is a long run science, essentially, and secondly, if it isn't that, we are talking about new capital investment and disinvestment that are long run. Now unless we get tooled up to do some long run research in this field of transportation, it is going to be worthless.

I will give you an example. Mr. Barkley said a little while ago that he would like to see some research done on country collection routes. We at Connecticut have been doing that for the last 50 years and I am glad we abandoned it finally. I don't care whether it is egg collection routes, milk collection routes, grain collection routes, those are pretty efficient now and I for one would not want to put any money in that general area of research.

We have to have long run research because of the terrific investments we are talking about and you have to give the research workers a lot more freedom than I think they are getting under present-day proposals.

DR. ARVIN BUNKER (Economic Research Service): I would like to follow up on Stan's point and direct that in the form of a question to Byron Nupp. How do you insure that your research contracts allow the researcher to be truly independent in his conclusions, in his analysis?

MR. LAUTH: I would like to go back to Stan's question which ties in with that, Arvin. Stan, I think I agree with respect to some need for long term research. I don't think there is much question about that. The problem is that we live in the world that we live in today and, again my perspective, and maybe the user of transportation or the shipper's perspective, is that we need more short-term, mission-oriented research right now to solve whatever problems we are faced with today. Now that doesn't mean that we shouldn't have long term research. We just can't wait for some of these other problems until that long term research is accomplished.

MR. NUPP: I want to make a comment on the question of objectivity of research in transportation, which I regard as the most serious problem we have in the research field, other than the agreement on research themes and designs, and I support the idea of longer range or more fundamental research in this field. The issues that confront transportation are controversial and the way the system is now organized almost everybody involved has a point of view and tends to use research to support his point of view.

I believe that we need to use legislative policy and other instrumentalities to assure that there are entities doing research which are apart from these controversies. There is a tradition of this in transportation that has been frustrated and I think we have to return to large scale research sponsored by official bodies that are set apart from the present agencies of government and the present interests in transportation. In regulatory practice we do have the discovery concept which the ICC does not use very much or has not used very much, but I think a broad scale independent research agency and a discovery approach are essential in this very partisan and controversial field. I think legislation should be enacted to bring this about, on the pattern of some of the past experiments in this field of transportation.

MR. LLOYD C. HALVORSON (Cooperative State Research Service): We have heard a lot of economists come out for deregulation. Now what sort of scares me is that I think we will have to have a lot of studies as to the rules of the game, rules of the competitive game, that will have to be developed for this sort of deregulation, and I doubt that the Federal Trade Commission control over competition in private firms today, or the Anti-Trust Division, will be adequate.

I want to ask Byron Nupp as to whether or not there are studies being funded and as to whether or

not he sees a role for agricultural colleges in making studies as to the rules of the game that need to be established for competition in the transportation industries. I want to point out, for example, that the decreasing cost condition of railroads and the different cost structures of the various modes are going to call for a very complex restructuring of the rules of the game for competition in the transportation industry.

MR. NUPP: I am happy to respond to that because I frankly don't believe that the issue in transportation regulation is one of regulation versus deregulation at all.

Now in transportation today—in the system which Bill Southard helps regulate—we have a lot of competition, a lot of deregulation, a lot of competitive incentives. We have also a lot of rules of the game, a lot of regulations, a lot of concepts whereby the government and the states interfere with these things.

Now the changes that the Department of Transportation is proposing are essentially conservative. We propose introducing new kinds of players in the competitive game. We are trying to introduce some new things in the regulatory game. We will have a new kind of ball club which we hope will win the game and in a sense will solve some of the country's transportation problems through the right mixture, the right combination of competitive incentives and the right combination of regulatory incentives.

I think that the research that has been done on competitive incentives on the whole has been very good and shows roughly what economic theory would tend to hold, that competition is an orderly process. I think we are deficient in devising new ways of regulating. The old regulatory ideas are going to have to be modernized and changed and we are deficient in devising new regulatory concepts or rules of the game. For this reason, the Department of Transportation has taken a conservative and incremental approach to regulatory reform. We are proposing working within the traditions of the Interstate Commerce Act and the Federal Aviation Act but we are proposing incremental change so that we move within this tradition. We are trying to improve the present system, both with respect to the competitive incentives and the regulatory process.

# Panel on Rural Transportation Research Funding Trends

Drs. Roland R. Robinson and
Lloyd C. Halvorson,
Mr. David W. Johnson

DRS. ROLAND R. ROBINSON and LLOYD C. HALVORSON (Principal Agricultural Economists, Cooperative State Research Service, U.S. Department of Agriculture): The Cooperative State Research Service (CSRS) of the U.S. Department of Agriculture administers funds appropriated by Congress for agricultural and forestry research. The legislation providing this support consists of (1) the Hatch Act of 1887, as amended; (2) the McIntire-Stennis Act of 1962; (3) the Act of August 4, 1965, or P.L. 89-106; and (4) the Rural Development Act of 1972. Most of the funds administered by CSRS are allocated on a formula basis to institutions. Only a small percentage of total funds are allocated to projects on a competitive basis.

In FY 1977, about $126.6 million were appropriated for agricultural and forestry research (table 1). About $122.2 million (96.4 percent) were allocated to institutions by formulas, while $4.5 million (3.6 percent) were allocated to projects on a competitive basis. Three sets of institutions receive formula funds. The State Agricultural Experiment Stations receive Hatch funds, the Schools of Forestry receive McIntire-Stennis funds, and the "1890" Institutions and Tuskegee are the recipients of the institutional components of P.L. 89-106 funds. Both public and private research institutions and organizations may compete for the competitive grant component of P.L. 89-106 funds.

Now let me describe the transportation research program supported by formula funds and by the competitive grant component of P.L. 89-106.

In 1975, there were 34 projects, classified mostly as transportation research, underway in the institutions receiving CSRS-administered formula funds. All of these projects were being conducted by the State Agricultural Experiment Stations (SAES). This is a rather small number considering that there are more than 600 research projects underway in the SAES in the related field of marketing economics and 19,000 projects in all disciplines. About 10.6 Scientist-Years (SY's) were devoted to these 34

Table 1. Research funds administered by the Cooperative State Research Service of the U.S. Department of Agriculture, Fiscal Year 1977

| Source and distribution of funds | Dollars appropriated | Percent of total* |
|---|---|---|
| Funds distributed to institutions by formulas | | |
| Hatch Act | $97,973,000 | 77.36 |
| McIntire-Stennis Act | 8,212,000 | 6.48 |
| Title V of the Rural Development Act | 1,500,000 | 1.18 |
| P.L. 89-106 | 13,352,000 | 10.54 |
| CSRS Administration Appropriation | 1,115,000 | .88 |
| Subtotal | 122,152,000 | 96.44 |
| Funds distributed competitively to projects | | |
| P.L. 89-106 | 4,500,000 | 3.55 |
| Total | 126,652,000 | 100.00 |

*Does not equal 100 percent due to rounding.

projects again a rather small input considering that about 6,133 SY's were allocated to all research conducted by the SAES.

Total expenditures from both Federal and State sources on these 34 projects amounted to $546,114. This also appears to be a relatively small commitment since total SAES research expenditures from all sources were around $500 million in 1975. The regional distribution of transportation research projects being conducted in the SAES is:

| Region | No. of Projects | Scientist-Years | Total Expenditures |
|---|---|---|---|
| North Central | 15 | 3.1 | $270,882 |
| Northeast | 6 | 2.6 | 150,649 |
| South | 7 | 2.5 | 51,118 |
| West | 6 | 2.4 | 118,465 |
| Total | 34 | 10.6 | $546,114 |

Since 1975, there has been some expansion in transportation research conducted by SAES. The major development has been the approval and activation of North Central Regional Research Project no. 137—Evaluation of Alternaitve Rural Freight Transportation, Storage and Distribution Systems. The project has the following objectives:

A. To estimate rural freight transportation requirements to 1985 and 1990.
B. To estimate optimal rural freight transportation, storage, and distribution systems.
C. To evaluate the economic effects of alternative railroad ownership and financial policies.
D. To evaluate the economic effects of alternative Federal, State and local policies on carriers, shippers, receivers and rural communities.

Total funding for NC-137 at the beginning of the current FY was about $158,016. Both participation and investment in this project is expected to increase in the next two years.

Table 2 shows the history of research funding under P.L. 89-106 from 1966 to 1977. Several characteristics emerge. First, the program started in 1966 with $2 million in support and has grown to about $17.9 million in 1977. Except for 1974 and 1977, the trend in funding has been upward. Second, the institutional component allocated on a formula basis has increased significantly relative to the competitive grant component allocated on a project basis. In 1977, about 75 percent of P.L. 89-106 funds were designated for institutional programs and about 25 percent for competitive-grant projects. Third, the areas of research supported under P.L. 89-106 have tended to expand over time. Since 1966, 17 different research areas have been supported. In 1966, only three research areas were supported, while 12 are supported in 1977.

Another feature of funding under P.L. 89-106 is that there has been considerable turnover in areas of work supported. Soybean research has been supported during the entire life of the program. However, most other areas over the past 12 years have lasted only three or four years and some even less.

Table 2. History of competitive project and institutional research funding under P.L. 89-106. fiscal years 1966-77 (in thousands)

| Programs supported | Fiscal years | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 1975 | | | | |
| | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | Initial | Redirected | 1976 | Transition quarter | 1977 |
| Competitive Grants to Further USDA Programs | | | | | | | | | | | | | | |
| Environmental quality | – | – | – | – | – | – | – | – | – | $600 | -$325 | $600* | $150* | – |
| Food & nutrition | – | – | – | – | – | – | – | – | – | 750 | – | 715 | 179 | – |
| Food & agriculture policies | – | – | – | – | – | – | – | – | – | – | – | 150 | 38 | $150 |
| Taro research | – | – | – | – | – | – | – | – | – | – | +75 | 75 | 19 | – |
| Beef & pork production | – | – | – | – | – | – | – | – | – | 750 | – | 1,425 | 356 | 400 |
| Lone Star tick research | – | – | – | – | – | – | – | – | – | – | – | 75 | 19 | – |
| Soybean research | $105 | $400 | $401 | $355 | $295 | $370 | $400 | $400 | $400 | 500 | – | 500 | 125 | 500 |
| Pest management research | – | – | – | – | – | – | – | 900 | – | 500 | – | 500 | 125 | 500 |
| Rural development | – | – | – | – | – | 75 | 225 | 317 | 300 | 300 | – | 300 | 75 | 300 |
| Transportation, marketing and storage | – | – | – | – | – | – | – | – | – | – | – | 500 | 125 | 500 |
| Forage, pasture & range research | – | – | – | – | – | – | – | – | – | – | – | 800 | 200 | 400 |
| Soil erosion in Pacific Northwest | – | – | – | – | – | – | – | – | – | – | – | 200 | 50 | 350 |
| Genetic vulnerability | – | – | – | – | – | – | – | – | – | – | – | 500 | 125 | 300 |
| Pesticide clearance | – | – | – | – | – | – | – | – | – | – | +250 | 500 | 125 | 1,000 |
| Cotton research | 1,000 | 431 | 1,000 | 984 | 1,000 | 1,000 | 1,900 | 1,900 | – | – | – | – | – | – |
| Corn blight | – | – | – | – | – | 1,000 | 500 | – | – | – | – | – | – | – |
| Mechanisms of resistance | – | – | – | – | – | – | – | 500 | – | – | – | – | – | – |
| Non-chemical methods of pest control | – | – | – | – | – | – | 500 | 500 | – | – | – | – | – | – |
| Miscellaneous | 895 | 886 | 116 | 378 | 422 | 272 | 92 | – | – | – | – | – | – | – |
| Environmental plant research in Hawaii | – | – | – | – | – | – | – | – | – | – | – | – | – | 75 |
| Dried bean research in North Dakota | – | – | – | – | – | – | – | – | – | – | – | – | – | 25 |
| Subtotal | 2,000 | 1,717 | 1,517 | 1,717 | 1,717 | 2,717 | 3,617 | 4,517 | 700 | 3,400 | – | 6,840 | 1,710 | 4,500 |
| Formula Grants for 1890 Land-Grant Institutions and Tuskegee Institute | | 283 | 283 | 283 | 283 | 283 | 8,883 | 10,833 | 10,833 | 11,824 | – | 12,706 | 3,176 | 13,352 |
| Total | 2,000 | 2,000 | 1,800 | 2,000 | 2,000 | 3,000 | 12,500 | 15,400 | 11,583 | 15,224 | – | 19,546 | 4,886 | 17,852 |

*The total $750,000 includes a one-time reprogramming for Predator Control in the amount of $50,000–1976, $33,000; TQ, $17,000.

The longevity of any particular research area under P.L. 89-106 is uncertain.

Funding for transportation research under P.L. 89-106 started in 1976 with $625,000 ($500,000 in FY 1976 and $125,000 for the transition quarter). In FY 1976, 19 proposals were submitted. Eight or about 42 percent were approved and funded. Transportation research is also being funded at the $500,000 level in FY 1977. Assuming an average level of support of about $90,000 per proposal, as was the case in 1976, about six to eight proposals will be funded in 1977. The competition this year is expected to be much keener than last year.

MR. DAVID W. JOHNSON (Chief, Procurement Operations Division, Office of the Secretary of Transportation): Before discussing business aspects, I'd like to talk a little about how the U.S. Department of Transportation is organized and then use my organization, the Office of the Secretary of Transportation (OST), as a more specific example to explain some of the various offices and types of programs that may be of interest to this audience. My first figure shows the overall organization, and the second one, that of OST. I will come back to Figure 1 later.

Let's look at Figure 2.

1. Top Row—The Contract Appeals Board resolves problems, if any.
2. Second Row—Note operational as well as policy offices—this is an unusual organization for a "head shed" in Federal Departments.
3. Procurement Operations Division—Office of Administrative Operations.
4. TSC—Has its own procurement division.
5. Office of University Research—contract program is approximately $2 million per year; about 35 new contracts and 12 renewals per year—some of these contracts are in areas or relate to rural transportation.
6. Office of Rural Transportation Policy—this indicates support of DOT for this rural area. As you know, having already heard from him this morning, Bob Bruton is Director of that office.

Before discussing how to do business with DOT, it is necessary to indicate where business impacting rural transportation comes from, what types of programs are involved, and approximately how much is involved. There are billions of dollars for grants from DOT, particularly in highway construction, but with a few minor exceptions, grants go to State and local governments. These State and local governments then issue contracts for planning and construction, and any work flowing to the private sector from these grants is initiated and administered by these governmental bodies.

My remarks today are limited to business or programs funded by DOT agencies by contracting directly with either companies, nonprofit organizations or universities in the private sector. One exception which might be mentioned is the university research program in the Urban Mass Transportation Administration. This office awards grants to universities, but they relate primarily to urban mass transit. Anyone interested in this program may contact this office on area code (202) 426-0080 for further information.

I have already mentioned the Office of University Research in my organization. Of necessity this is a contract program since OST has practically no statutory authority to issue grants. An annual solicitation is issued each year under this program. Proposals are due back for this year (FY 1977) by December 1. I assume that most of you here are aware of this program. If not, you may contact the Office of University Research on area code (202) 426-0190. If time permits, I will answer any questions about this or any other OST procurement program after my presentation.

The three modal administrations shown on Figure 1 are the primary ones that have funds to support projects relating to rural transportation. Again, the bulk of the money is in grants to States. However, FAA, FHWA and FRA do support some planning and research studies in their respective areas of responsibility directly by contracts. Some examples of these follows:

*FAA.*—Pertinent areas relating to rural transportation include research and planning studies in automating air traffic control; noise monitoring and impact; airport feasibility and capability studies; economic impact on communities of closing, relocating or building airports; upgrading small rural and commuter airports; and planning for construction projects including airport access roads. These research studies amount to several million dollars per year.

*FRA.*—Contract awards for research are in the area of transportation of commodities such as grain and coal; approximately $400,000 are currently budgeted for this area, much of which will affect rural transportation directly or indirectly. Planning under the Railroad Revitalization and Regulatory Reform Act of 1976 which we bureaucrats euphemistically call the 4-R Act, will also result in some FRA contracts. Much work in the area of rehabilitation planning will be the responsibility of State DOT's which will also be awarding substantial numbers of contracts. Universities, particularly Land Grant schools, should be in a good position to compete with private firms in obtaining business from their State or local governments in this area. Another area of potential business is the Northeast Corridor Project recently established in FRA.

*FHWA.*—Using total dollars as a measure, in terms of both grants and contracts, the biggest spender in areas affecting rural transportation has to be the Federal Highway Administration. Some examples of contract programs which are a drop in the bucket when compared with highway construction grants, are the $9 million budgeted for safety in FY

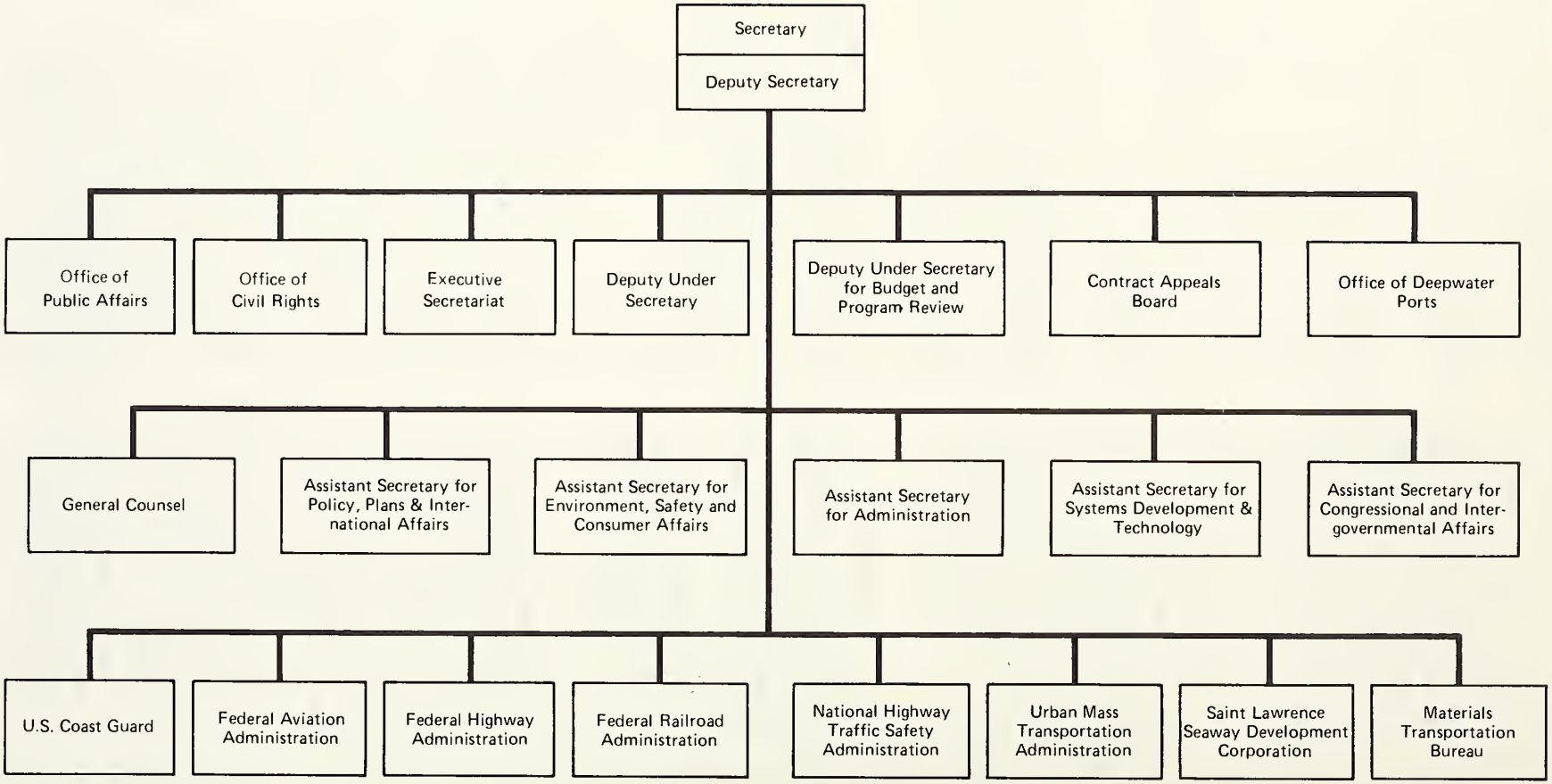

Secretary
Deputy Secretary
Office of Public Affairs
Office of Civil Rights
Executive Secretariat
Deputy Under Secretary
Deputy Under Secretary for Budget and Program Review
Contract Appeals Board
Office of Deepwater Ports
General Counsel
Assistant Secretary for Policy, Plans & International Affairs
Assistant Secretary for Environment, Safety and Consumer Affairs
Assistant Secretary for Administration
Assistant Secretary for Systems Development & Technology
Assistant Secretary for Congressional and Intergovernmental Affairs
U.S. Coast Guard
Federal Aviation Administration
Federal Highway Administration
Federal Railroad Administration
National Highway Traffic Safety Administration
Urban Mass Transportation Administration
Saint Lawrence Seaway Development Corporation
Materials Transportation Bureau

**Figure 1. Organization of the U.S. Department of Transportation**

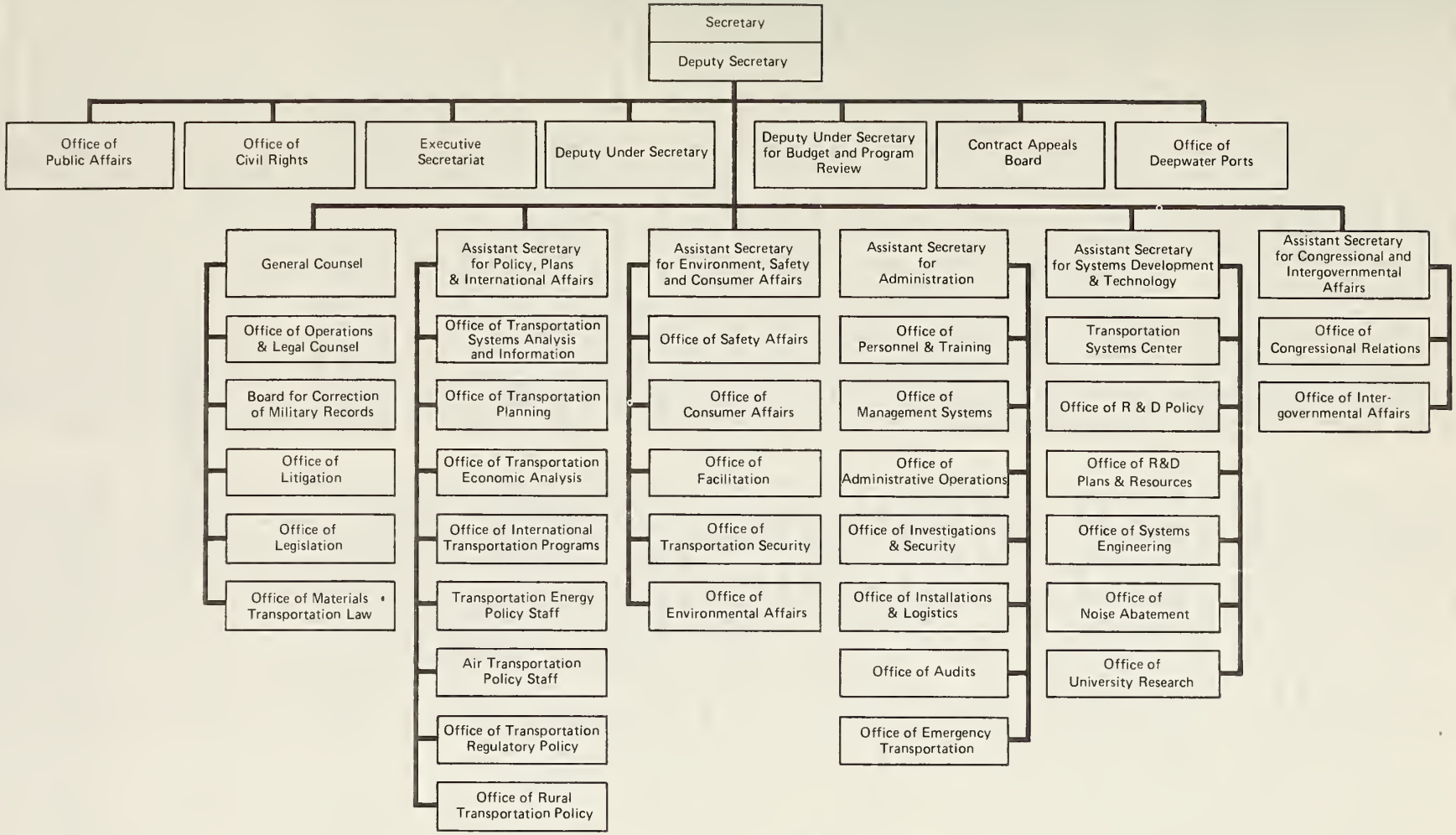

Secretary
Deputy Secretary
Office of Public Affairs
Office of Civil Rights
Executive Secretariat
Deputy Under Secretary
Deputy Under Secretary for Budget and Program Review
Contract Appeals Board
Office of Deepwater Ports
General Counsel
Office of Operations & Legal Counsel
Board for Correction of Military Records
Office of Litigation
Office of Legislation
Office of Materials Transportation Law
Assistant Secretary for Policy, Plans & International Affairs
Office of Transportation Systems Analysis and Information
Office of Transportation Planning
Office of Transportation Economic Analysis
Office of International Transportation Programs
Transportation Energy Policy Staff
Air Transportation Policy Staff
Office of Transportation Regulatory Policy
Office of Rural Transportation Policy
Assistant Secretary for Environment, Safety and Consumer Affairs
Office of Safety Affairs
Office of Consumer Affairs
Office of Facilitation
Office of Transportation Security
Office of Environmental Affairs
Assistant Secretary for Administration
Office of Personnel & Training
Office of Management Systems
Office of Administrative Operations
Office of Investigations & Security
Office of Installations & Logistics
Office of Audits
Office of Emergency Transportation
Assistant Secretary for Systems Development & Technology
Transportation Systems Center
Office of R & D Policy
Office of R&D Plans & Resources
Office of Systems Engineering
Office of Noise Abatement
Office of University Research
Assistant Secretary for Congressional and Intergovernmental Affairs
Office of Congressional Relations
Office of Inter-governmental Affairs

**Figure 2. Organization of the Office of the Secretary, U.S. Department of Transportation**

'77 ($10 million requested for FY '78) of which about 40 to 50 percent will directly benefit rural transportation through research on skid resistant pavings, improving grade crossings, bridge structure stability in high winds and improved hazard warnings on rural roads. In the area of highway R&D, $14.2 million is budgeted for FY '77. About two-thirds of this will either directly or indirectly benefit rural highways, and indicates the trend to greater federal financial support in this area.

The above are just some examples of programs supported by contract funding in various agencies within DOT that have a beneficial effect on transportation of both goods and people in rural areas. It is obvious to me that the overall support of rural transportation is pervasive throughout the entire department. For instance, UMTA has programs to improve transportation for the elderly and handicapped, and getting people in and out of large and small cities, that have potential to improve rural as well as urban transportation. I think it is safe to say, therefore, that DOT is committed to, and is in fact expending large amounts of effort and resources to improve rural transportation. I frankly am proud to be part of this effort, at least from a business and financial standpoint. Not only because I enjoy my work and get satisfaction from seeing contracts my division awards help improve transportation (perhaps slowly but certainly surely), but also because I am personally convinced that a balanced, efficient transportation system is vital to the economic and social well being of this country.

Having mentioned something about the various organizations within DOT and some examples of the types of programs supported directly by contracts that may impact rural transportation, we come to the $64 question—how do you get in on the action? Or specifically, how do you get contracts? A booklet handed out here at the registration desk gives general information on who buys what in DOT and the location of the various procurement offices.

In addition to programs specifically set up for educational institutions such as the OST University Research Program, there are at least two other methods available to everyone, profit and non-profit institutions alike, for obtaining contracts.

If you think you have a good idea, send it to the appropriate procurement office that serves the organization with primary interest in the area of your proposal's subject. Your idea will be competing with programs already approved and other unsolicited proposals for the limited uncommitted funds available. It has to be an outstanding idea, but if it is really good, it can get funded. Such proposals historically have a poor batting average, about 3-5 percent at a maximum of proposals received in any one year get supported. It is a viable way, however, to get your ideas evaluated, commented on and possibly supported.

The primary method by which DOT, and all Federal agencies for that matter, contract for research and planning-type studies and support is the Request for Proposals (RFP). When there is a need for a study on any work estimated to cost over $5,000, notification is published in the Commerce Business Daily which lists nearly all Federal procurements. Anyone can subscribe through the Government Printing Office or nearest Department of Commerce field office for $105.00 per year first class mail. Wading through this document is a chore, but the payoff, if you're serious about getting government contracts, will be worth it.

The best way to obtain contracts, therefore, is to have RFP's mailed directly to you. You should also get on bidders' lists at agencies that have programs of interest to you. To get on bidders' lists, contact the procurement offices of interest and request to be placed on the lists. Each office maintains its own list. I cannot guarantee that you will get all RFP's in which you are interested. Our OST list is large and cumbersome; everyone wants our business. The list is rotated, so there is no guarantee that you will receive all RFP's in your area of interest. Therefore, the Commerce Business Daily is still the best way to be sure that you see all RFP's.

On the positive side, I have noticed more and more universities bidding on our RFP's. There is no reason why universities cannot compete successfully with anyone for such business as they are interested in. In OST, they do it all the time, and I assume also in other areas of the Federal Government. They obviously have the talent and experienced people. We encourage their participation and wish them luck.

# Discussion

DR. ARVIN R. BUNKER (Economic Research Service): Over the last three days we have had a number of researchers and policymakers and others suggest that they need more information *now*. I think what they are saying is that they need more short-term research and in spite of what Stan Seaver would argue, we do do short-term research as economists, but most of the short-term research can only be done if the basic research is available. I think it is a real mistake to assume that you can forever fund short-term research. After a while the basic knowledge would not be there to do that sort of thing.

Is there any plan to increase the funding of long-term research relative to short term?

DR. ROBINSON: Our competitive grants, run for five years and we approve many Hatch projects for three to five years. One of the criteria that is used in evaluating competitive grant proposals is the strength of the ongoing program that relates to the proposal. In many instances, a research grant is just additive to what is going on. It builds on a long-term program, so I don't really feel that that could be a criticism of the kind of university research projects and programs that we administer.

But I do think there has to be a balance. There are decisions that have to be made every day and if they are not made, there are associated costs. I don't know what proportions of short-term versus long-term research you need but you certainly need both. Of course, in the university and the Land Grant system, we usually think that Extension does brush-fire research and provides data and information for those kinds of needs. I feel that we have a pretty reasonable balance.

MR. DAVID JOHNSON: I didn't want to exclude long-term research. First of all, again in my own frame of reference, OST has a little bit of a problem because we are sort of a quick-response office to the Secretary, and the kinds of things we buy primarily (I will use university research as an example because of the audience here) is an important program that gets a lot of visibility and a lot of support but we are still only talking a $2 million budget a year and that was set up basically for short-term research.

However, even there, many universities have programs for up to three years. What we do is fund the first year. We require at least a preliminary report to come in at the end of the first year, which is evaluated. If the work looks promising, we will fund for up to two more years, at which point, if the work is good and shows promise the chances are that someone will pick it up.

I don't want to say a lot because I really don't know the details of what the modal administrations are doing, but I am sure that Highways particularly in road construction research, things like that, is doing quite a bit. I am most familiar with OST, and by our nature we are short term.

A lot of times we sort of "study the studiers." We will get competing requirements from, let's say, Federal Rail and Federal Highway, as to how to do something or which area to support for a particular project. Then what we will have to do at OST, because we are sort of the bridge between the two modes, we will actually have to go out and get more research or consulting work to help us in our decision.

We are a little different than somebody who is really involved in an operating mode such as aviation or road building or railroads, and I can't really speak for those people except to say I know they are doing some.

DR. STANLEY SEAVER (University of Connecticut): It occurred to me when Mr. Johnson was talking earlier that I must have been a little misunderstood or maybe I used the wrong words, and I don't like to be misunderstood. I was using "long term" to mean long run applications. We need research in transportation dealing with long run problems, some ideal allocation of resources in the long run. I wasn't really talking about short-run financing of research, although one year, following the last suggestion, is pretty short in financing also.

I was pleading for much more of the funds to be allocated to studies that deal with some ideal allocation of resources in the long run, but there is also, I see, a problem of the length of run in the financing of research. You are not going to get a lot of good proposals dealing with the long run ideal allocation of resources that you are going to be able to complete in one year.

MR. DAVID JOHNSON: There is the opportunity, of course, to finance up to three years. We just break in the funding for (a) budget purposes and (b) to try and get some type of evaluation within the first year. Again, that is just the university research program itself. It is not everything else that we in the Department buy. That is just one program that I thought was of interest.

MR. SIDNEY H. EVANS (North Carolina A&T): I want to direct this question to Dr. Robinson. Just how rigid is the formula for allocating the P.L. 89-106 funds? Is it a matter of the slice getting larger only because of a bigger pie or can it be enlarged with a given size of pie?

DR. ROBINSON: I am not familiar with all those formulae, but I know the Hatch formula is based on population, both farm and total rural, in any State relative to the total in the U.S., and the forestry formula is based on, I think, two criteria. One has to do with the volume of sales of the forest industries and this sort of thing.

The only thing I know about the institutional program under P.L. 89-106 is that it is allocated on a formula basis and it may be that those 16 institutions are essentially getting about an equal share of that total fund. It may be a modification of the Hatch formula. I am not certain of that. But I would assume that in the short run the way to receive additional support is for the pie to get bigger, and it has almost every year. Hopefully that continues. I think your chances are best in the short run for the pie getting bigger rather than getting a bigger slice of it.

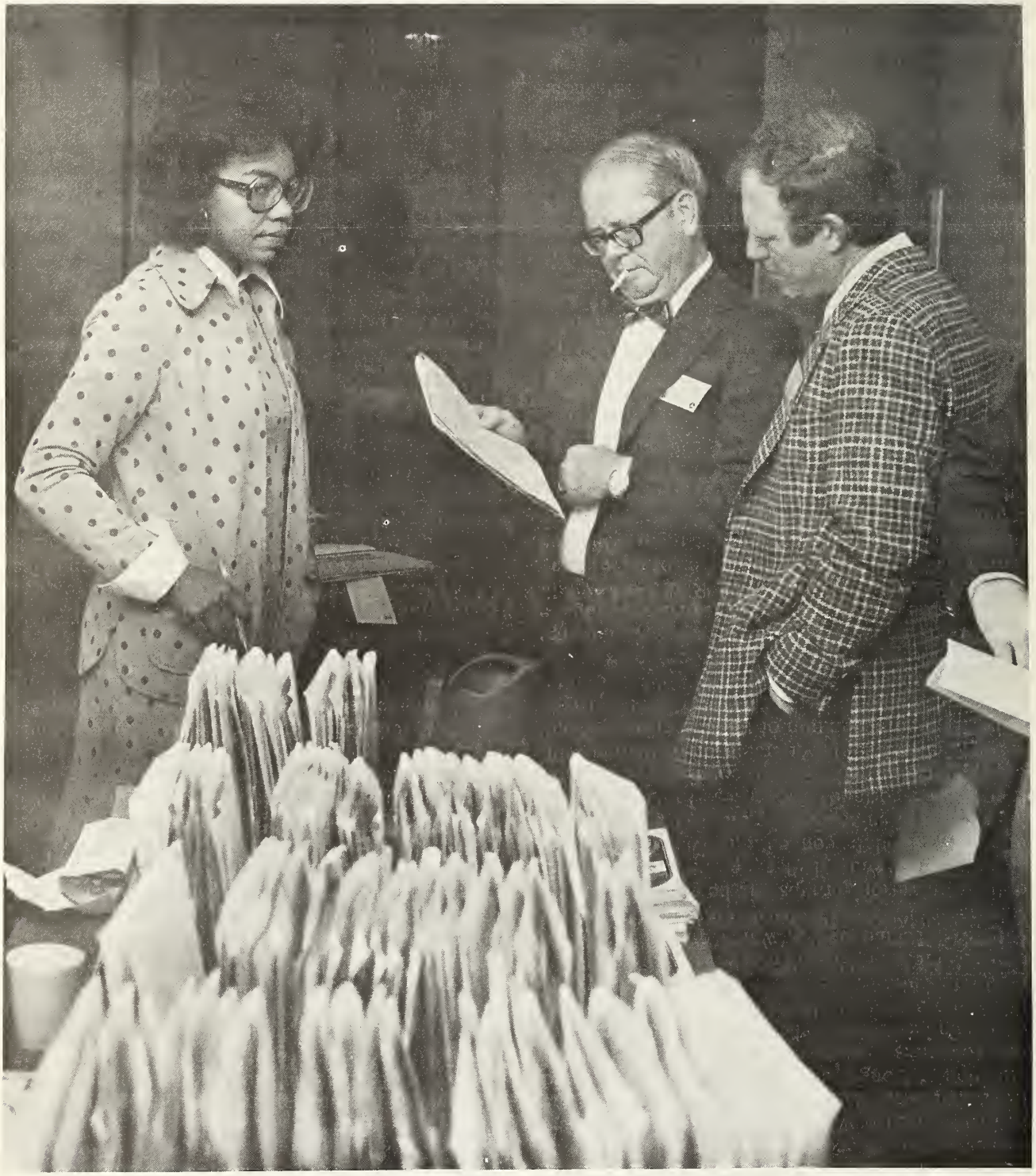
DR. JOHN O. GERALD (Economic Research Service): I have a very sad duty to perform. I am sure that all of you heard of the death of one of our attendees, Mr. Herman Kappel of the Association of American Railroads, Director of Closed Car Utilization. This occurred Sunday night just after the reception. We have sent flowers in the name of the

Symposium for the funeral which will occur tomorrow in Washington, D.C.

Could I ask for a moment of remembrance for Mr. Kappel.

(Whereupon the assemblage united in silent tribute to the memory of Mr. Herman Kappel)

We have asked Orlo Sorenson to summarize the conference as he sees it.



**Helen Whitfield awaits decision from Joe Gerald and Bob Bruton; Bill Millar watches the photographer**

# Summary Observations

L. Orlo Sorenson
Professor of Agricultural Economics
Kansas State University

The stated objectives of the symposium were: (1) to stimulate an improved and expanded research program in rural transportation, and (2) to identify professional interfaces in rural transportation research. With these objectives, we would expect a report on the state of the arts (state of knowledge) in transportation research and an identification of problem areas that need to be addressed. To a very substantial degree the symposium has accomplished the objectives that were set for it, although we have perhaps emphasized research results a little more than we have identified specific areas of research needs.

Two keynoters, Drs. Meyer and Friedlaender, dealt primarily with the role of economists in transportation policy formulation. Each indicated that policy makers have not taken into account the views of economists to the extent that they (Meyer and Friedlaender) may have wished. John Meyer suggested that the economists' role has been primarily that of an early warning system, identifying basic trends in transportation industries which require the attention of Congress. Ann Friedlaender indicated that economists' views would get more attention if costs and benefits of policy alternatives were identified more specifically among various interest groups and affected parties. Mrs. Friedlaender then described research in progress at Massachusetts Institute of Technology in which quantitative measurements of the impacts of transportation policy options on various groups will be generated.

Both Meyer and Friedlaender expressed conventional views and the conventional wisdom which we have heard often concerning the need for deregulation of transportation industries. In Dr. Meyer's case especially, the financial condition of the railroads was laid at the doorstep of regulation with only minimal recognition of the organizational and structural problems in the railroad industry that in my judgement are much more significant in determining rail industry performance than any operational restrictions imposed by the Interstate Commerce Commission. Meyer pointed to efforts to introduce rate flexibility for railroads in the Railroad Revitalization and Regulatory Reform Act of 1976 as an important step in easing transport regulations and improving the financial condition of railroads. In a situation where a single railroad holds a virtual monopoly in railroad transportation over a large area (the CONRAIL case) improved railroad earnings will be the likely result of greater freedom to adjust to market conditions. Whether improved railroad performance and maintenance of equitable conditions among shippers and between shippers and carriers will result nationally from significant rate flexibility begs research evidence.

Dr. Friedlaender repeated her debatable contention presented elsewhere that regulation has produced a railroad rate structure favoring Midwest and Southwest agriculture. This is also a contention that needs the test of substantially more research evidence before I am willing to accept it. Wheat, for example, has had higher revenue-to-out-of-pocket-cost ratios in the historic rail rate structure than any other major bulk commodity. In my judgement, the "favored industry" argument is not demonstrated with hard evidence. Dr. Friedlaender's contention that substantial cross-subsidy exists in the motor freight industry to the benefit of rural communities is equally debatable, at least as it applies to the Midwest.

Papers concerning international trade and transportation presented on Monday morning identified significant research concerning U.S. domestic transportation of agricultural commodities for export but little research on the influence of transportation conditions beyond the exit port. This perhaps reflects a research focus in agricultural transportation in recent years on economically troubled rail transportation.

In summing up the first panel session, Dr. Hill indicated that we are still unable to provide answers to the following important questions:

(1) What will be the effect of changes in export transportation rates on export prices, local supplies, and on transportation mode shares?
(2) In reference to grain export, what is the effect of reduced export rates for large-volume shipments on prices paid by domestic processors and on prices paid to producers? (This question was also directed to Dr. Baumel by a symposium participant on Tuesday afternoon. In reply Dr. Baumel indicated that Iowa farmers are receiving higher prices for export corn and soybeans as a result of economies achieved through interior sub-terminal operation and unit-train shipment. However, in my judgement the distribution of benefits will be different in situations where intermodal competition is not as intense as with grain shipment

in the transport corridor from Iowa-Illinois to the Gulf.)

(3) What is the effect of a high degree of grain industry concentration (exports are handled largely by four firms) on grain export? (and, I might add, on the structure of export transportation rates and transport services? Large firms that dominate movements to export ports have the economic resources to develop informed positions on transportation issues and to register their positions in direct negotiation with railroads and in both the public policy and regulatory arenas.)

Hill indicated that we need to extend research into new areas and in international agricultural movements to include at least the very complex ocean freight rates in international trade analyses.

On Monday afternoon, six papers were presented under the heading, "The Impacts of Transportation Regulation on Agriculture." Drs. Daughety and Inaba described research underway at Northwestern University concerning differentiation and measurement of demand for freight transportation in which they are currently dealing with characteristics of demand for the transportation of grains. Given the notable lack of success of other researchers in efforts to measure transport demand characteristics, this is a courageous undertaking. Perle, for example, in a major effort to measure elasticities and modal cross-elasticities of demand for transport services had difficulty achieving statistically significant results. Drs. Daughety and Inaba discussed very innovative approaches. I am optimistic about the probability of a successful outcome of their efforts.

Dr. Mary Berglund reported on research aimed at better utilization of rail freight cars and the positive proposals that have developed from the very good research that has been carried out at the University of Nebraska.

But, the main thrust of the afternoon panel was aimed at regulation of the motor freight industry. Earlier, Professor Meyer suggested that economists had not been effective in the policy arena in some cases because they didn't always reach the same conclusions. This appears not to be a problem in recommending the direction of public policy in motor carrier regulations. The evidence presented was unanimous concerning benefits to shippers of easier entry and more competition in the trucking business.

Reported evidence sharply contrasted with Dr. Friedlaender's conclusion that, "The actual output and rates in the trucking industry are respectively, only slightly below and above those that would occur under a perfectly competitive market structure."

Georgia Canellos presented the results of a study of the probable consequences of deregulation on small rural communities and small shippers indicating less dependence upon regulated truckers than is sometimes assumed. Drs. Anderson and Felton outlined research procedures for studies being developed at the University of Nebraska for further estimation of the consequences for rural communities of motor carrier regulation/deregulation.

Dr. James Nelson's suggestion of permitting freight forwarders to operate as line-haul carriers in the U.S. as a step toward regulatory reform and improved intermodal coordination is a specific modification in the institutional framework for transportation that leads in the direction of greater flexibility in carrier operations. I think this is the way we move toward an improved regulatory framework in an orderly fashion rather than by wholesale measures to eliminate economic regulatory participation by government.

On Tuesday morning the focus turned to people transportation in rural areas. This area has received substantially less research attention than have the problems of rural freight transportation. But, I was pleased to hear that it has not been totally neglected. A good part of this session, especially in the question and answer period, was spent in identification of the problems. Perhaps this says something about the degree to which research has been supported in this area. Alice Kidder indicated that the Federal Department of Health, Education, and Welfare had been more active in support of studies and programs for people transportation in rural areas than either the Department of Transportation or the Department of Agriculture.

There appeared to be a consensus among panel participants that public transportation service in rural communities had deteriorated and will continue to do so both for local movement of people now owning automobiles and for intercommunity movement by bus and airplane. This is no doubt true, but there were two assumptions presented concerning intercommunity movement that I think need careful analysis.

The first contention (hypothesis) is that there is substantial cross-subsidy in the intercity bus industry and as a result bus service to rural communities will continue to decline as decline occurs in the ability of commercial carriers to continue the cross-subsidy. Arnold Levine indicates that current evidence from carrier accounting records is not adequate to prove or disprove the hypothesis of existing cross-subsidy. There is a contention in transportation literature that substantial cross-subsidy has existed also in the regulated motor freight industry to the benefit of rural communities. The cost structure of the industry is not one that leads to cross-subsidy among service points. The evidence, at least from my part of the country, leads me to believe that the pervasiveness of cross-subsidy in the motor freight industry has been overstated. Degree of cross-subsidy in the intercity bus industry needs to be carefully measured before public policy is formulated based on the assumption that it exists extensively.

The second contention in need of examination is that intercity air service to rural communities has declined. Number of scheduled flights by certificated carriers to rural communities has no doubt declined since 1973 reflecting increased emphasis on energy conservation. However, expansion in commuter service has occurred both on a scheduled and non-scheduled basis as indicated by Regina Van Duzee. The result may very well be a better matching of the supply of service with demand in rural communities with a net effect of improvement in intercity air service to rural communities.

In the afternoon session on Tuesday, questions centering on freight transportation in low-density rural areas were discussed with emphasis on two dimensions:

(1) the extent to which adjustment is forthcoming in rail networks, and
(2) techniques for evaluating the viability of specific facilities or projects.

The evidence presented by Dr. Weinblatt suggests that we have only seen the tip of the iceberg and that substantially greater "rationalization" of the rail system through abandonment is forthcoming. The evidence presented by Dr. Weinblatt and the results of Dr. Baumel's work both suggest that agricultural traffic alone is frequently not sufficient to sustain a branch line. Dr. Weinblatt reported that a CONSAD Research Corporation study indicates 17 percent of rail mileage outside the Northeast is potentially uneconomic branch line based on a minimum traffic volume of 70 carloads per mile per year for viability. In the West North Central region, 26 percent of rail mileage has been designated as potentially uneconomic. In the 31-state area the 17 percent potentially non-viable line originates 14.5 percent of agricultural traffic including 20 percent of wheat shipments. Based on the criterion used by CONSAD (which also raises questions) it appears that in spite of relatively equal distribution of agricultural traffic originations among branch and main lines, agricultural traffic cannot sustain many of the existing branch lines.

Dr. Baumel's analysis of rail branch lines in Iowa also suggests that estimated benefit/cost ratios greater than 1.0 for upgrading of lines was highly dependent upon the existence of sources of industrial traffic on those lines.

Generalizations based on carload traffic should be viewed with caution however, especially when reduced to specific applications. Dr. John Due's research indicated that with a given traffic level per mile, there is greater probability of sustaining a relatively short branch line than a longer one. Variations in railroad revenue/cost ratios by commodities also result in substantial variations in traffic/net revenue relationships based on the mix of commodities hauled.

In any case many of us will likely be concerned with evaluation of the viability of branch rail lines in the next few years and will do well to acquaint ourselves in detail with the kind of analysis that Phil Baumel has adapted for rail line analysis in Iowa and also to look further into project evaluation techniques used by the Federal Highway Administration and by the U.S. Army Corps of Engineers. Madeleine Bloom indicated the availability of rail costing programs from the Federal Railroad Administration; Clyde Weller discussed engineering economics applications to road projects for the U.S. Forest Service; and Marc Johnson urged greater application of Cost/Benefit analysis in the development of state rail plans under the 4-R Act.

In the Wednesday morning session, Arvin Bunker presented some very useful research information relating to the consequences of the application of user charges on inland river transportation. This is an important issue—one that has generated a lot of debate for many years but one which has been subjected to very little analysis by public agencies. We need more. Impacts of user charges will vary by shipping patterns; by river characteristics; and by regional differences in the configuration of competing modes.

Ken Brewer indicated that transportation adjustments to increased energy costs are going to be difficult to achieve in rural areas, partly because alternatives for much of the pattern of transportation and resulting patterns of energy use are difficult to find and, where alternatives are possible change is not readily accepted. Brewer's studies have led him to conclude that the possibility of severe energy shortage has not been incorporated into individual planning and decision frameworks. Observations of other panel members reinforced Brewer's conclusions.

Robert Bruton indicated relative lack of specific attention to rural and agricultural transportation in the U.S. Department of Transportation. He also indicated difficulty in specifying or defining areas that were uniquely agricultural or rural transportation concerns. Bruton indicated that it is a faulty premise that "rural areas are dependent upon government to provide transportation service." Bruton also indicated that public investment and policy emphasis has encouraged those modes and technologies that are suited to high density rather than low density markets. With policies designed to permit and encourage development of new transport techniques and new institutions through private and local government initiative, the performance of local transportation systems could be improved.

Local initiative for solution of local problems was also stressed by William Millar in discussion of Pennsylvania's role in rural passenger transportation.

The Wednesday afternoon sessions were devoted to summary statements and a presentation of research funding opportunities for University research in transportation provided through the U.S. Departments of Transportation and Agriculture.

The symposium covered a wide variety of topics pertinent to rural and agricultural transportation. If there was a recurring theme throughout the conference it seemed to be the need for greater flexibility in allowing private operators and local communities to exercise initiative in solution of problems within local transportation markets.

Our compliments to the organizers of the symposium. I have found it an extremely informative conference and I know that others have also.

Inez Sletta and Mary Jenny assemble nameplates for a session

# Appendix

## PLANNING COMMITTEE

Dr. Kenneth L. Casavant, *Chairman;* Associate Professor of Agricultural Economics, Washington State University.
Dr. A. D. Seale; Associate Director of the Agricultural and Forestry Experiment Station, Mississippi State University.
Dr. Walter Miklius; Professor of Economics and Agricultural Economics, University of Hawaii.
Dr. R. James Hildreth; Managing Director, Farm Foundation.
Dr. Robert J. Tosterud, *Co-Director of Staff;* Director of the Upper Great Plains Transportation Institute, North Dakota State University.
Dr. John O. Gerald, *Co-Secretary and Co-Director of Staff;* Leader of the Transportation Economics Program Area, Economic Research Service, U.S. Department of Agriculture (USDA).
Dr. Roland R. Robinson; Principal Agricultural Economist, Cooperative State Research Service, USDA.
Mr. Robert Bruton; Acting Director of the Office of Rural Transportation Policy, U.S. Department of Transportation (USDOT).
Mr. William F. Brown, *Co-Secretary and Co-Director of Staff;* Research Program Manager in the Office of University Research, USDOT.

## STAFF

Dr. Jerome J. Hammond, Economic Research Service, USDA.
Ms. Alice Polit, Economic Research Service, USDA.
Ms. Inez Sletta, Office of the Secretary, USDOT.
Mr. Wilbur Williams, Office of University Research, USDOT.
Mr. Gene Griffin, Upper Great Plains Transportation Institute.
Ms. Mary Jenny, Upper Great Plains Transportation Institute.
Mr. Clyde Linsley, Office of Public Relations, USDOT.
Mr. Raymond Bridge, Economic Research Service, USDA.
Ms. Helen Whitfield, Office of University Research, USDOT.

## EDITING COMMITTEE

Dr. John O. Gerald, *Principal Editor*
Dr. Kenneth L. Casavant
Dr. Robert J. Tosterud
Mr. William F. Brown

## ATTENDANTS

William V. Alexander
(U.S. Representative from Arkansas)
House of Representatives
Cannon House Office Bldg.
Washington, DC 20515
(202) 225-4076

Dale O. Anderson
Greater North Dakota Assn.
107 Roberts Street
Fargo, ND 58102
(701) 237-9461

Dale G. Anderson
Department of Agricultural Economics
University of Nebraska
Lincoln, NE 68503
(402) 472-3402

P. Bryce Appleton
Special Consultant
Air Transportation Policy Staff
Office of the Secretary
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0577

Alan Austad
Research Director
North Dakota Farmers Union
Box 651
Jamestown, ND 58401
(701) 252-2340

Ralph O. Avery
Assistant Vice President for Pricing
Burlington Railroad
176 E. 5th Street
St. Paul, MN 55101
(612) 298-3234

Paul Barkley
Department of Agricultural Economics
Washington State University
Pullman, WA 99163
(509) 335-5556

Lanny Bateman
Mississippi State University
P.O. Box 5187
Mississippi State, MS 39762

C. Phillip Baumel
Department of Agricultural Economics
Iowa State University
Ames, IA 50010
(515) 294-7318

John T. Berg
Federal Highway Administration
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0570

Mary Berglund
University of Nebraska
Department of Agricultural Economics
Lincoln, NE 68503
(402) 472-3402

Nelson Bills
Economic Research Service, NRED
U.S. Department of Agriculture
Cornell University
Ithaca, NY 14850

James K. Binkley
Department of Agricultural Economics
VPI and State University
Blacksburg, VA 24061
(703) 951-5913

Madeleine S. Bloom
U.S. Department of Transportation
Federal Railroad Administration
400 7th Street, SW
Washington, DC 20590
(202) 755-2008

Debbie Bodin
Project Manager, Southern Mississippi Planning and Development District
1020 32nd Avenue
Gulfport, MS 39501
(601) 868-2311

Patrick P. Boles
Economic Research Service, NEAD
U.S. Department of Agriculture
Room 250, 500 12th Street, SW
Washington, DC 20250
(202) 447-6363

James Boone
Federal Railroad Administration
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-9682

Joe Dan Boyd
Regional Editor, Farm Journal
543 1st Bank and Trust Bldg.
Richardson, TX 75080
(214) 231-6033

Philip Bradway
Chief Marketing Representative
New York Department of Agriculture and Markets
State Campus, Bldg. 8
Albany, NY 12235
(518) 457-3485

Phil L. Breakiron
U.S. Department of Agriculture
BARC-West
Beltsville, MD 20705

Kenneth Brewer
Civil Engineering Department
378 Town Engineering Bldg.
Iowa State University
Ames, IA 50010

Charles Brewer
Assistant Professor of Business Administration
North Carolina A&T State University
Greensboro, NC 27411
(919) 379-7656

Ronald Briggs
Assistant Professor and Associate, Council for Advanced Transportation Studies
University of Texas at Dallas
P.O. Box 688-G31
Richardson, TX 75080
(214) 690-2044

Robert T. Brown
Senior Chief, 8th Coast Guard District
U.S. Coast Guard
Courthouse Bldg.
New Orleans, LA 71030
(504) 522-5917

William F. Brown
Office of University Research
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0190

David M. Brown, Jr.
Region Domestic Shipping Officer
U.S. Department of Commerce
Maritime Administration
2828 International Trade Mart
No. 2 Canal Street
New Orleans, LA 70130
(504) 589-6544

Robert H. Bruton
Office of the Secretary, TPI-80
Room 10301
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-4435

James W. Buky
Southern Regional Manager
American Commercial Barge Line Co.
826 Perdido Street
New Orleans, LA 70112
(504) 581-7541

B. G. Bullard
Chief, Systems Branch
Federal Highway Administration
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-2925

Arvin Bunker
Economic Research Service, NEAD
U.S. Department of Agriculture
Room 250, 500 12th Street, SW
Washington, DC 20250
(202) 447-6363

James H. Burt
Director of Agricultural Relations
The American Trucking Associations
1616 P Street, NW
Washington, DC 20590
(202) 797-5435

Bernard F. Byrne
Assistant Professor
Department of Civil Engineering
West Virginia University
Morgantown, WV 26506
(304) 599-0295

Patrick R. Cain
Intermodal Planner
Iowa Department of Transportation
826 Lincoln Way
Ames, IA 50010
(515) 296-1680

Georgia A. Canellos
Office of the Secretary, TPI-74
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-4420

Peter Canga
Economic Development Specialist
Texas Department of Community Affairs
210 Barton Springs Road
Austin, TX 78711
(512) 475-6601

Domonic L. Carney
Agricultural Specialist and Office Manager
State Department of Commerce and Economic Development
12th Floor, MacKay Bldg.
338 Denali Street
Anchorage, AK 99501

Kenneth L. Casavant
Department of Agricultural Economics
Washington State University
Pullman, WA 99163
(509) 568-8231

C. C. Cates
Executive Director, Northwest Tennessee Economic Development Council
R-3, Everett-Stewart Airport
Union City, TN 38261
(901) 885-1400

Patricia Cavanaugh
Editorial Assistant, Transport Topics
1616 P Street, NW
Washington, DC 20036
(202) 797-5252

Lat Celmins
Commerce Attorney
Greyhound Corp., Inc.
Greyhound Tower
Phoenix, AZ 85077

Harry L. Clowers
Manager, Ride, Inc.
Anderson County Community Action
135 E. Broad Street
Clinton, TN 37716
(615) 457-2154

Katherine E. Collins
Planning Analyst
Bureau of the Budget
524 S. Second Street, Room 315
Springfield, IL 62706
(217) 782-5414

Bruce A. Connell
Attorney-Advisor, Office of Proceedings
Interstate Commerce Commission
Room 3410
Washington, DC 20423
(202) 275-6431

Joseph R. Corley
Extension Economist
U.S. Department of Agriculture
Extension Service
Washington, DC 20250
(202) 447-4520

James Cornelius
Department of Agricultural Economics
Montana State University
Bozeman, MT 59715
(406) 994-3701

Warren C. Couvillion
Department of Agricultural Economics
Mississippi State University
P.O. Box 5187
Mississippi State, MS 39762
(601) 325-2750

Charles D. Covey
Professor and Assistant Chairman for Extension
Food and Resource Economics Dept.
1167 McCarty Hall
University of Florida
Gainesville, FL 32611
(904) 392-1877

Katherine Y. Cudlipp
Professional Staff Member
Public Works Committee
U.S. Senate
Washington, DC 20510
(202) 224-6249

Richard T. Dailey
Director, Center for Business Development and Research
University of Idaho
Moscow, ID 83845
(208) 885-6611

Andrew F. Daughety
The Transportation Center
Northwestern University
Evanston, IL 60201
(312) 492-3603

Nelson Denlinger
Legislative Assistant
Senator Hubert H. Humphrey
Room 232, Old Senate Office Bldg.
Washington DC 20510
(202) 224-9481

Victor M. DeKalb
Chief, Transportation Planning Engineer
USDA Forest Service, Engineering Staff
12th and Independence Ave., SW
Washington, DC 20250
(703) 235-9845

Kenneth W. Downey
Planning and Research Engineer
FHWA-Louisiana Division
Federal Bldg., 750 Florida St.
Baton Rouge, LA 70801
(504) 387-0181

John Due
Department of Economics
University of Illinois
Urbana, IL 61801
(217) 333-2747

Austin Engel
Director, State Planning Division
State Capitol Bldg.
Bismarck, ND 58505
(701) 224-2818

Sidney H. Evans
Chairman, Department of Economics
North Carolina A&T State University
Greensboro, NC 27411
(919) 379-7744

Richard Fee
Managing Editor, Big Farmer Magazine
131 Lincoln Highway
Frankfort, IL 60423
(815) 469-2163

John Richard Felton
Department of Economics
University of Nebraska
Lincoln, NE 68503
(402) 472-2318

Robert Fetter
Director, Market Research
Southern Railway Company
P.O. Box 1808
Washington, DC 20013

Alan E. Finder
Council of State Governments
P.O. Box 11910
Iron Works Pike
Lexington, KY 40511

Nathan I. Finkelstein
Attorney, Office of Public Counsel
Interstate Commerce Commission
1900 L Street, NW
Washington, DC 20016
(202) 254-3495

John Finsness
Attorney, North Dakota State Wheat Commission
1129 5th Avenue South
Fargo, ND 58102
(701) 237-3166

Marion S. Fleming
Chief, Regional Analysis
Economic Branch
Canadian Transport Commission
275 Slater Street
Ottawa, Ontario, Canada K1A ON9
(613) 995-9543

Joanne D. Fort
Staff Assistant, Committee on Rural and Urban Development
National Governors Conference
Suite 600, 1150 17th Street, NW
Washington, DC 20036

Ronald G. Fraase
Marketing Specialist
North Dakota State Wheat Commission
1305 E. Central Avenue
Bismarck, ND 58505
(701) 224-2498

Mark D. Freeman, Jr.
Director of Regulatory Services and Executive Assistant
Mississippi Department of Agriculture and Commerce
P.O. Box 1609
Jackson, MS 39205
(601) 354-6569

Ann Friedlaender
Department of Economics
Massachusetts Institute of Technology
Cambridge, MA 02139
(617) 253-3456

Jerry E. Fruin
Research Associate, Department of Agricultural and Applied Economics
University of Minnesota
231 COB
St. Paul, MN 55108
(612) 376-3568

Stephen Fuller
Associate Professor, Department of Agricultural Economics
Texas A&M University
College Station, TX 77840
(713) 845-3031

Senator Fitzsimons
Senate Transportation Committee
State Capitol
St. Paul, MN 55155
(612) 296-4181

Floyd D. Gaibler
Economic Research Service, NEAD
U.S. Department of Agriculture
Room 250, 500 12th Street, SW
Washington, DC 20250
(202) 447-6363

Ronald E. Gargasz
Chief, Rural Transportation Division
Pennsylvania Department of Agriculture
2301 N. Cameron Street
Harrisburg, PA 17120
(717) 783-8460

E. Brinkley Garner
Economist, Office of Economics
Interstate Commerce Commission
Room 5380
Washington, DC 20423
(202) 275-7375

Peter V. Garrod
Assistant Professor of Agricultural Economics
University of Hawaii
Bilger Hall
2545 The Mall
Honolulu, HI 96822
(808) 948-8800

Wayne M. Gauthier
Assistant Professor
Department of Agricultural Economics and Agribusiness
Louisiana State University
Baton Rouge, LA 70803
(504) 388-5314

Marvin Gelles
Traffic Management Branch, ASCS
U.S. Department of Agriculture
Washington, DC 20250
(202) 447-7881

Donald R. Geoffrion
Deputy Secretarial Representative
U.S. Department of Transportation
Suite 515, 1720 Peachtree Road, NW
Atlanta, GA 30309
(404) 526-3738

John O. Gerald
Economic Research Service, NEAD
U.S. Department of Agriculture
Room 250, 500 12th Street, SW
Washington, DC 20250
(202) 447-6363

James Giltmier
Committee on Agriculture and Forestry
U.S. Senate
Washington, DC 20510
(202) 224-6922

Lynda Given
Research Assistant, National Association of Counties
1735 New York Ave., NW
Washington, DC 20006
(202) 785-9577

Frank R. Glick
Assistant Divisional Traffic Manager-South
Hunt-Wesson Foods
P.O. Box 61770
New Orleans, LA 70150

Sandy Golub
Logistics Analyst, Farmland Industries
3315 North Oak Trafficway
Kansas City, MO 64116
(816) 459-6390

Denis B. Grace
Deputy Port Director for Trade Development
Board of Commissioners of the Port of New Orleans
No. 2 Canal Street
New Orleans, LA 70130

C. Warren Green, Jr.
Transportation Marketing Agent
Virginia Department of Agriculture and Commerce
203 N. Governor Street
Richmond, VA 23228
(703) 786-8737

Gene Griffin
Research Economist
Upper Great Plains Transportation Institute
ND State University
Fargo, ND 58102
(701) 237-7767

Reid M. Grigsby
Assistant Commissioner
Louisiana Department of Agriculture
P.O. Box 44302, Capitol Station
Baton Rouge, LA 70804
(504) 389-5563

Gerald A. Hagen
State Director, United Transportation Union
735 Division Street
Altoona, WI 54720
(715) 832-6516

Lloyd C. Halvorson
U.S. Department of Agriculture
CSRS, Room 431-W
Washington, DC 20250
(202) 447-2584

Jerome J. Hammond
Economic Research Service, NEAD
U.S. Department of Agriculture
Room 250, 500 12th Street, SW
Washington, DC 20250
(202) 447-6363

Merle Harbourt
Southern Regional Representative
The American Waterway Operators, Inc.
Suite 1027, Whitney Bldg.
New Orleans, LA 70130
(504) 524-3366

William Harding
Director of Transportation
Louis Dreyfus Corp.
24 Richmond Hill Avenue
Stamford, CT 06904
(203) 357-8444

John Harvey
Research Leader, Market Quality and Transportation Research Lab.
U.S. Department of Agriculture, ARS
P.O. Box 8143
Fresno, CA 93727
(209) 487-5334

James W. Henderson
Chief, Transportation Rates
Transportation Department
Louisiana Public Service Commission
One American Place, Suite 1630
Baton Rouge, LA 70825
(504) 389-5867

Robert C. Hendon
Vice President, Consolidated Freightways
6845 Elm Street, Suite 608
McLean, VA 22101
(703) 356-0620

Harold E. Henn
Deputy Director, Office of Community Development
Edgar A. Brown Bldg.
1205 Pendleton Street, Suite 308
Columbia, SC 29201

Lowell D. Hill
Department of Agricultural Economics
University of Illinois
305 Mumford Hall
Urbana, IL 61801
(217) 958-9142

Ronald G. Hoffman
Director, Transportation Policy Development
Minnesota Highway Department
818 Highway Bldg.
John Ireland Blvd.
St. Paul, MN 55155
(612) 296-8531

Mac R. Holmes
Assistant Professor, Department of Agricultural Economics
Georgia Experiment Station
Experiment, GA 30212
(404) 228-7232

O. Wendell Holmes
Executive Secretary, Great Plains Agricultural Council
205 Filley Hall, East Campus
University of Nebraska
Lincoln, NE 68583
(402) 471-5447

Steve Holmgren
Marketing Department, Union Pacific Railroad
1416 Dodge Street
Omaha, NE 68179
(402) 271-4508

Larry L. Hoover
Supervisory Auditor
U.S. General Accounting Office
Suite 300-D
2420 W. 26th Avenue
Denver, CO 80211

Verner G. Hurt
Mississippi State University
P.O. Box 5187
Mississippi State, MS 39762
(601) 325-2750

T. Q. Hutchinson
Economic Research Service, NEAD
U.S. Department of Agriculture
Room 250, 500 12th Street, SW
Washington, DC 20250
(202) 447-6363

W. W. Imboden
Traffic Manager, Indiana Farm Bureau Coop. Assn., Inc.
47 S. Pennsylvania Street
Indianapolis, IN 46204
(217) 631-8361

F. S. Inaba
The Transportation Center
Northwestern University
Evanston, IL 60201
(312) 492-5015

Anil B. Jambekar
Associate Professor of Management Sc.
School of Business, M.T.U.
Houghton, MI 49931
(906) 487-2811

Rudy Janota
American Commercial Barge Line
New Orleans, LA

Mark Jelavich
Jack Faucett Associates
5454 Wisconsin Avenue
Chevy Chase, MD 20015
(301) 657-8223

Mary Jenny
Upper Great Plains Transportation Institute
North Dakota State University
Fargo, ND 58102
(701) 237-7767

David W. Johnson
Chief, Procurement Operations Division
Office of the Secretary
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0028

Joanne Johnson
Research Associate
Prairie View A&M University
Prairie View, TX 77445
(713) 857-2714

Joyce Johnson
Research Associate
Transportation Institute
North Carolina A&T State University
Greensboro, NC 27411
(919) 379-7745

Marc A. Johnson
Assistant Professor, Department of Agricultural Economics
Oklahoma State University
Stillwater, OK 74074
(405) 372-6211

Clifford Jones
Economic Research Service, NRED
U.S. Department of Agriculture
304 U.S. Post Office and Courthouse Bldg.
Little Rock, AR 72201
(501) 378-5447

James R. Jones
Department of Agricultural Economics
University of Idaho
Moscow, ID 83843
(208) 885-6262

Paul S. Jones
Associate Professor of Industrial and Systems Engineering
Georgia Institute of Technology
Atlanta, GA 30332
(404) 894-2308

H. P. Kappel — Deceased
Director, Closed Car Utilization
Association of American Railroads
1920 L Street, NW
Washington, DC 20036
(202) 293-4180

Bob Kent
TRIP, West Virginia Department of Welfare
1900 Washington Street, E.
Charleston, WV 25305

Edward D. Kern
Agricultural Marketing Specialist
State Division of Agriculture
Box 1088
Palmer, AK 99645
(907) 745-3236

Alice E. Kidder
Associate Professor of Economics
North Carolina A&T University
Greensboro, NC 27411
(919) 379-7745

Mary Kihl
Center for Appalachian Studies
University of Pittsburgh
Johnstown, PA 15904

Joseph A. Kinney
PAD/Transportation Staff
U.S. General Accounting Office
441 G Street, NW
Washington, DC 20548
(202) 376-5368

Marvin E. Konyha
Program Leader, Manpower Development and Community Facilities, ES
U.S. Department of Agriculture
Washington, DC 20250
(202) 447-3444

Steven Kopperud
Feedstuffs Assistant Managing Editor
Miller Publishing Company
2501 Wayzata Blvd.
Minneapolis, MN 55440
(612) 374-5200

Loren Kruze
Farm Management Editor, Successful Farming, Meredith Corporation
1716 Locust Street
Des Moines, IA 50315
(515) 284-9285

Wes R. Kriebel
Extension Economist, Department of Agricultural Economics
Pennsylvania State University
University Park, PA 16802
(814) 865-2561

Charles E. Lamberton
Assistant Professor of Economics
Department of Economics
South Dakota State University
Brookings, SD 57006
(605) 688-4141

Jack Lamkin
Assistant Research Economist
Texas Transportation Institute
Texas A&M
College Station, TX 77843
(713) 845-1716

William E. Lane
Transportation Consultant, North Carolina Dept. of Agriculture, Division of Markets
2 W. Edenton Street
Raleigh, NC 27611
(919) 829-7136

James H. Lauth
Director, Transportation & Warehouse Division, AMS
U.S. Department of Agriculture
Washington, DC 20250
(202) 447-7423

Naomi W. Ledi
Texas Southern University
Urban Resources Center
Houston, TX 77004

James H. Lemly
Professor, Transportation and Marketing
Georgia State University
University Plaza
Atlanta, GA 30303
(404) 658-2740

Arnold Levine
Office of the Secretary, TPI-74
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-4303

Clyde T. Linsley, Jr.
Office of Public Affairs
Office of the Secretary
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0398

William T. Manley
Deputy Administrator, AMS
U.S. Department of Agriculture
Washington, DC 20250
(202) 447-4276

Hari P. Marhatta
Assistant Professor, Department of Economics
North Carolina A&T State University
Greensboro, NC 27411

Marlene K. Markison
Community Planning Coordinator
Office of Intergovernmental Affairs
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-1524

Eugene L. McCord
Georgia Dept. of Transportation
No. 2 Capitol Square
Atlanta, GA 30334
(404) 656-5320

Paul K. McDevitt
Assistant Professor of Economics
New Mexico State University
Box 3CQ
Las Cruces, NM 88003
(505) 646-1905

John R. Meyer
Department of Economics
Harvard University
Cambridge, MA 02138
(617) 495-6326

Richard J. Mikes
Assistant Controller
Ruan Transport Corp.
666 Grand Avenue
Des Moines, IA 50309
(515) 245-2559

Walter Miklius
Department of Agricultural Economics
University of Hawaii at Manoa
Room 459, 2540 Maile Way
Honolulu, HI 96822
(808) 948-7981

William Millar
Pennsylvania Department of Transportation
Transportation & Safety Building
Harrisburg, PA 17120

Paul L. Mills
Chief, Transportation Services Branch, AMS, Room 1755
U.S. Department of Agriculture
Washington, DC 20250
(202) 447-5995

John W. Mitchell
Department of Economics
Boise State University
1910 College Blvd.
Boise, ID 83725
(208) 385-3351

Ed Moody
Governor's Office of Planning
303 American Foundation Bldg.
4th and Ringo
Little Rock, AR 72201
(501) 371-2611

David Moser
Department of Agricultural Economics
University of Missouri
Columbia, MO 65201
(314) 882-2831

N. G. Mulder
Assistant Deputy Minister
Strategic Planning, Transport Canada
Place de Ville, Tower C 22 E
Ottawa, Ontario, Canada K1A ON5
(613) 593-5680

Robert D. Murphy
Analyst, U.S. Department of Transportation
Room 9216, TPI-12
400 7th Street, SW
Washington, DC 20590

James C. Nelson
N.E. 1036 "D" Street
Pullman, WA 99163
(509) 332-2150

E. S. Neumann
Assistant Professor
Department of Civil Engineering
West Virginia University
Morgantown, WV 26506
(304) 599-0295

N. J. Nessen, Jr.
Market Manager–Grains and Grain Products
Rock Island Lines, Room 700
LaSalle Station
Chicago, IL 60605
(312) 435-7427

Byron Nupp
Office of the Secretary
TPI-22, Room 10309
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-4447

William F. Odendahl
Director, Transportation Analysis Group
U.S. Forest Service, Box 245
2020 Milvia Street, Suite 302
Berkeley, CA 94701
(415) 449-3624

Senator Olhoft
Senate Transportation Committee
State Capitol
St. Paul, MN 55155
(612) 296-4181

David R. Olson
Staff Assistant, Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515
(202) 225-2141

Howard E. Olson
Institute for Water Resources
U.S. Army Corps of Engineers
Kingman Building
Ft. Belvoir, VA
(202) 325-0477

Raymond M. Owensby
Assistant Research Economist
Texas Transportation Institute
Texas A&M University
College Station, TX 77843
(713) 845-1716

Mechel S. Paggi
Department of Agricultural Economics
Texas A&M University
College Station, TX 77843

I. W. Paul
Galveston Chapter
American Red Cross
1124 24th Street
Galveston, TX 77550

John H. Pentecost
Federal Program Coordination Specialist, RDS
U.S. Department of Agriculture
Room 4125
Washington, DC 20250
(202) 447-2578

J. W. Pendleton
Transportation Coordinator
Zapata Haymie Corporation
P.O. Box 1918
Houma, LA 70361
(504) 868-0330

Robin Peterson
Professor and Head, Marketing and General Business
New Mexico State University
Las Cruces, NM 88003
(505) 646-3341

John H. Phipps
Development Engineer
Caterpillar Tractor
100 NE Adams
Peoria, IL 61629
(309) 675-5407

Charles Pixton
Transportation Specialist
Appalachian Regional Commission
1666 Connecticut Ave., NW
Washington, DC 20235

Alice Polit
Economic Research Service, NEAD
Southern Regional Research Center
U.S. Department of Agriculture
P.O. Box 19687
New Orleans, LA 70179

Leonard A. Poth
Assistant Director, Business Research Bureau
University of South Dakota
Vermillion, SD 57069
(605) 677-5287

Roselyn A. Price
Deputy Director
Macon County Community Action
312 E. Northside Street
Tuskeegee, AL 36083
727-1430

Senator Purfeerst
State Transportation Committee
State Capitol
St. Paul, MN 55155
(612) 296-4181

Stewart A. Reeve
Illinois Field Editor
Pariric Farmer
P.O. Box 1642
Decatur, IL 62525
(217) 877-9070

Donald F. Rehl
Director, Marketing-Agriculture
Consolidated Rail Corporation
Six Penn Center Plaza, Room 504
Philadelphia, PA 19104
(215) 593-3057

Edward I. Reinsel
Economic Research Service, NEAD
U.S. Department of Agriculture
Room 246, 500 12th Street, SW
Washington, DC 20250
(202) 447-8821

Richard T. Roberts, Jr.
Senior Planner
Alabama-Tombigbee Regional Commission
Camden, AL 36726
(205) 682-4234

Gip I. Robertson, Jr.
Assistant to the Director
Arkansas State Highway Department
9500 New Benton Highway
P.O. Box 2261
Little Rock, AR 72203

Roland R. Robinson
U.S. Department of Agriculture
CSRS, Room 413-W
Washington, DC 20250
(202) 447-6050

Mac E. Rogers
Director of Office of Federal Assistance
Region 2, Federal Railroad Administration
995 Lost Forest Drive
Sandy Springs, GA 30328
(404) 526-7801

Muriel Rothstein
Director, Office of Rural Affairs
Dutchess County Committee for Economic Opportunity, Inc.
East Main Street
Amenia, NY 12501
(914) 373-8186

Jill S. Rowe
Assistant Editor, Farmland News
Farmland Industries
P.O. Box 7305
Kansas City, MO 64116
(816) 459-6313

J. William Rush
Transportation Professor
Mississippi State University
Box 938
Mississippi State, MS 39762
(601) 325-3163

Eugene Russell
Department of Civil Engineering
Kansas State University
Manhattan, KS 66056

Erhardt O. Rupprecht
Economic and Sector Planning
Office of Agriculture
U.S. Agency for International Development
Room 2246 NS
U.S. Department of State
Washington, DC 20523
(202) 632-7936

Arthur Saltzman
Institute of Transportation Studies
University of California
Social Science Building
Irvine, CA 92717
(714) 833-5989

Lyn Sander
Information Systems
Battelle Columbus Laboratories
505 King Avenue
Columbus, OH 43201
(614) 424-7675

James E. Sanders
Traffic Manager, Gold Kist, Inc.
244 Perimeter Center Pkwy NE
Atlanta, GA 30346
(404) 393-5048

Senator Schmitz
Senate Transportation Committee
State Capitol
St. Paul, MN 55155
(612) 296-4181

Mike Schofield
Market Information Specialist
Office of Market Development
Maritime Administration
No. 2 Canal Street, Suite 2824
New Orleans, LA 70130
(504) 589-6571

Alvin R. Schupp
Associate Professor
Department of Agricultural Economics
Louisiana State University
Baton Rouge, LA 70803
(504) 388-3283

A. D. Seale
Associate Director, Agriculture and Forestry
Experiment Station
Mississippi State University
Mississippi State, MS 39762
(601) 325-4737

Stanley K. Seaver
Department of Agricultural Economics
University of Connecticut
Storrs, CT 06268
(203) 244-2000

Frank Sheehan
Galveston Chapter
American Red Cross
1124 24th Street
Galveston, TX 77550

Inez Sletta
Office of the Secretary, S-5
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0163

L. Orlo Sorenson
Department of Agricultural Economics
Kansas State University
Manhattan, KS 66502
(913) 532-6705

William Southard
Manager, Special Projects Staff
Interstate Commerce Commission
Room 200, 1030 15th Street, NW
Washington, DC 20005
(202) 296-0440

Stewart M. Startt
Transportation Manager
Arizona Feeds
P.O. Box 5526
Tucson, AZ 85703
(602) 887-2202

Yorgos Stephanedes
Graduate Student, Thayer School of Engineering
Dartmouth College
Box 8000
Hanover, NH 03755
(603) 646-2119

Jolene Stevens
Writer-Editor (Farm Profit, Massey-Ferguson)
Creative Services
3612 SW 9th
Des Moines, IA 50315

Earline Strickland
Mississippi Valley State University
Itta Bena, MS 38941

Edward C. Sullivan
Associate Research Engineer and Lecturer
Institute of Transportation Studies
111 McLaughlin Hall
University of California
Berkeley, CA 94720
(415) 642-4609

Michael Swanson
Vice President–Transportation
Cook and Company
2185 Democrat Road
Memphis, TN 38116
(901) 396-8600

Morris H. Taylor
Director, Office of Transportation
Utah State University
Extension Economics Department
UMC 35
Logan, UT 84322
(801) 752-4100

Daymon W. Thatch
Associate Professor, Department of Agricultural Economics and Marketing
Cook College Office Bldg.
P.O. Box 231
New Brunswick, NJ 08903
(201) 932-9270

Bill Thoms
University of North Dakota
Grand Forks, ND 58201

Wayne C. Thomas
Associate Professor of Economics
University of Alaska
309 Resources Bldg.
Fairbanks, AK 99701
(907) 479-7189

Dennis L. Thompson
Coordinator, Graduate Programs in Public Policy and Administration
State University of New York at Binghamton
Binghamton, NY 13901
(607) 798-2252

Stanley R. Thompson
Assistant Professor, Department of Agricultural Economics
Michigan State University
E. Lansing, MI 48823
(517) 353-9733

Stanley K. Thurston
U.S. Department of Agriculture
Room 550, 500 12th Street, SW
Farmer Cooperative Service
Washington, DC 20250
(202) 447-8800

Robert J. Tosterud
Director, Upper Great Plains Transportation Institute
North Dakota State University
Fargo, ND 58102
(701) 237-7767

Edward W. Tyrchniewicz
Department of Agricultural Economics and Farm Management
University of Manitoba
Winnipeg, Manitoba, Canada R3T 2N2
(204) 474-9801

Dwaine E. Umberger
USDA-ERS/LACIE
Room 120, Federal Bldg.
600 E. Cherry
Columbia, MO 65201
276-3222

Sylvester VanBuren
Manager, Warehouse and Distribution
Southern Farmers Assn.
824 No. Palm Street
No. Little Rock, AR 72114
(501) 945-2371

Regina Van Duzee
Federal Aviation Administration
Room 935-10A, AVP-120
U.S. Department of Transportation
800 Independence Ave., SW
Washington, DC 20591
(202) 426-3103

Norman Walker
General Traffic Manager
Bunge Corporation
300 Southwest Blvd.
Kansas City, KS 66103
(913) 236-6500

Mike Walsten
Associate Editor, Professional Farmers of America
219 Parkade
Cedar Falls, IA 50613
(319) 277-1278

Stanley Weil
Traffic Representative
Southwestern Motor Freight, Inc.
4320 Hessmer Avenue, P.O. Box 786
Metairie, LA 70004
(504) 888-4150

Herbert Weinblatt
Consad Research Corporation
121 North Highland Street
Pittsburgh, PA 15206
(412) 363-5500

Walter W. Welch
Miles College
Birmingham, AL 35208

Clyde G. Weller
Engineering, Forest Service
517 Gold Street, SW
Albuquerque, NM 87102
(505) 766-2419

Helen Whitfield
Office of University Research
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0190

Gilbert Wiedenhoeft
Transportation Analyst
Public Service Commission of Wisconsin
4802 Sheboygan Avenue
Madison, WI 53702
(608) 266-2321

Fred H. Wiegmann
Head, Department of Agricultural Economics and Agribusiness
Louisiana State University
Baton Rouge, LA 70803
(504) 388-3282

Gerald L. Wilkins
Managing Director and Editor
Agri-Management Resource Group
P.O. Box 141
Eustis, FL 32726
(904) 357-0832

Wilbur Williams
Office of University Research
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-0190

Allan Williams
Senate Transportation Committee
Room 328, State Capitol
St. Paul, MN 55155
(612) 296-4181

Walter Wills
Professor, Ag. Ind. Dept.
Southern Illinois University
Carbondale, IL 62901
(618) 453-2421

Louis N. Wise
Vice President for Agriculture and Forestry
Mississippi State University
P.O. Box 5386
Mississippi State, MS 39702
(601) 325-5456

Henry J. Yunck
Director of Transportation
FAR-MAR-CO., Inc.
1600 North Lorraine
Hutchinson, KS 67501
(316) 663-6861

Martin Zell
Associate Administrator
Federal Railroad Administration
U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590
(202) 426-9682

## NOTICE TO ATTENDANTS

Two significant reports on the costs and benefits of transportation regulation were released after the National Symposium on Transportation for Agriculture and Rural America was held. While neither report is devoted exclusively to transportation for agriculture and rural America, both of them contain considerable reference to such transportation. For the benefit of those attendants desiring to obtain further insight into the costs and benefits of transportation regulation, full citations and addresses for obtaining information about availability of the reports follow:

1. Interstate Commerce Commission, Bureau of Economics
   A Cost and Benefit Evaluation of Surface Transport Regulation. November 22, 1976.
   Address: Bureau of Economics, Interstate Commerce Commission, 12th Street and Constitution Avenue NW, Washington, D.C. 20423
2. Executive Office of the President, Council on Wage and Price Stability
   The Interstate Commerce Commission's Staff Analysis of the Costs and Benefits of Surface Transport Regulation. January 19, 1977.
   Address: Council on Wage and Price Stability, 726 Jackson Place NW, Washington, D.C. 20506

## Statistical Profile of Pre-Registrants
(As of November 5, 1976)

| *By Affiliation* | |
|---|---|
| Legislative | |
| U.S. Congress | 1 |
| State Senators (Unlisted by name) | 4 |
| Congressional Staff | 6 |
| General Accounting Office | 2 |
| State Legislative Staff | 1 |
| Regulatory Agencies | |
| Interstate Commerce Commission (4 offices) | 4 |
| State Public Service Commissions | 2 |
| Canadian Transport Commission | 1 |
| Executive Agencies | |
| Transport Canada | 1 |
| Maritime Administration | 2 |
| Department of Transportation (10 units) | 21 |
| Department of Agriculture (9 agencies) | 27 |
| Department of State | 1 |
| Tennessee Valley Authority | 1 |
| State Departments of Agriculture | 11 |
| State Departments of Transportation* | 6 |
| State Planning Agencies* | 15 |
| Local Government Planning and Action Agencies | 19 |
| Universities | |
| Administrative | 10 |
| Agricultural Economics Research** | 20 |
| Agricultural Economics Extension | 5 |
| General Economics and Business | 13 |
| Civil Engineering | 6 |
| Development Research Centers* | 4 |
| Transportation Research Centers* | 12 |
| Associations of Governments | 3 |
| Agri-Business Associations | 8 |
| Transportation Associations | 3 |
| Transportation Labor Union | 1 |
| Transportation Firms | 9 |
| Transportation Managers for Agri-Business Firms | 9 |
| Consultants | 3 |
| Print Media | 8 |
| Total pre-registrants | 239 |

| *By Geographic Area* | |
|---|---|
| Pacific States (including Alaska and Hawaii) | 15 |
| Northern Intermountain (Montana, Idaho, Wyoming) | 4 |
| Southern Intermoutain | 5 |
| Northern Plains | 20 |
| Southern Plains | 6 |
| Cornbelt & Lake States (including Kentucky) | 42 |
| South Central (excluding Louisiana) | 22 |
| Louisiana | 12 |
| Northeast | 19 |
| D.C. | 59 |
| Southeast | 32 |
| Canada | 3 |
| Total pre-registrants | 239 |

*Possibly overlapping classifications.
**Some do teaching and probably extension work as well.

Copy of letter from Bennett C. Whitlock, President, American Trucking Associations, Inc.

November 23, 1976

The Honorable John Knebel
Secretary of Agriculture
Washington, D.C. 20250

Dear Mr. Secretary:

On behalf of the American Trucking Associations, I wish to express concern over the one-sidedness of the recent "National Symposium on Transportation for Agriculture and Rural America" in New Orleans.

Those portions of the program which dealt with the motor carrier industry were devoted entirely to the presentation of views of advocates of deregulation of the industry.

The fairness in providing a forum, at taxpayers expense, for only one side of an issue has to be questioned.

ATA is concerned now that some 200 of the symposium's attendees are back home in state departments of agriculture and in their classrooms at land grant universities assuming that there is wide-spread support for deregulation, which is of course a minority view set forth mainly by the Department of Transportation theorists.

Several months before the symposium, ATA representatives were assured by the Department of Agriculture's Economic Research Service that the symposium would not be used as a deregulation forum. Furthermore, ATA representatives were advised that each paper to be presented at the symposium would be based on transportation research which was completed or underway.

This was not the case. While speakers referred to "studies" which have or are being done, they used wide emotional and editorial license to attack regulation and the American Trucking Associations.

ATA is considering preparation of a paper on the symposium to be distributed to those who attended the meeting. This, however, is a less than satisfactory substitute for fair and unbiased discussion at the symposium itself.

In closing, let me emphasize it is the view of the trucking industry that the handling of this symposium by the Department of Agriculture was an abuse of the trust placed in government by its citizens.

Sincerely,

/s/ Bennett C. Whitlock, Jr.

Copy of letter from Gary C. Taylor, Acting Deputy Administrator, Economic Research Service

December 14, 1976

Mr. Bennett C. Whitlock, Jr.
President, American Trucking Associations, Inc.
1616 P Street, NW
Washington, D.C. 20036

Dear Mr. Whitlock:

Your letter to Secretary Knebel concerning the National Symposium on Transportation for Agriculture and Rural America was referred to the Economic Research Service for reply.

We regret that your organization feels that the Symposium sessions on November 15 were unfair. Since one of the main functions of the Symposium was to facilitate exchange of views, copies of your letter and this reply are being provided to the planning committee for mention, or inclusion in full, in the printed proceedings of the Symposium. A copy of this reply is also being sent to the Editor of Transport Topics. Further, the Symposium planning committee has asked the Interstate Commerce Commission for copies of its report on costs and benefits of regulations that was released on November 22. If these are available, copies will be distributed to persons attending the Symposium.

ERS was only one of several sponsors of this Symposium. Dr. Gerald's comments about the Symposium in late August to Mr. James H. Burt of your organization were based on knowledge of the intent of ERS and other sponsors and of the plans at that time. These included a series of sessions for presentation of research papers with an allowance of some time in each session for reactions from both public and private interests. A period for further open discussion was also scheduled in the concluding session of the meeting. Dr. Gerald was unaware of any significant publicly sponsored rural transportation research not uncovered by the planning committee, but he offered to relay any suggestions Mr. Burt might have to it.

As a co-sponsor, ERS did not intend to provide a forum for advocacy of any position, but neither did it tell program participants what they could or could not say. Thus, what was said does not necessarily reflect the views of ERS or the policies of this Department.

Nonetheless, the Symposium furnished a productive atmosphere for sharing research results and benefiting from a broad cross-section of public and private viewpoints. We believe that future research and transportation decisions stand to gain from this process and that it, therefore, served the public interest.

Thank you for bringing your views to our attention.

Sincerely,

/s/ Gary C. Taylor
Acting Deputy Administrator

Copy of letter from Kenneth L. Casavant, Chairman of the Planning Committee for a National Symposium on Transportation for Agriculture and Rural America

December 3, 1976

Mr. Ernest Olson
Director, Office of Economics
Interstate Commerce Commission
12th and Constitution Avenue
Washington, D.C. 20423

Dear Mr. Olson:

A National Symposium on Transportation for Agriculture and Rural America was recently held in New Orleans on November 14–17. The purpose of the Symposium was to present findings of research and to stimulate new research on transportation problems facing agriculture, forestry, and rural areas. The Symposium was well attended (230–250 attendants) with a broad audience including academic researchers, state and local planners, and trade people.

Our Planning Committee wants to move rapidly to capture the benefits of the Symposium, therefore we are compiling an edited proceeding of the Symposium program for release in the near future. The program included a discussion of research findings on benefits and costs of regulatory reform in the November 15th afternoon session. At the time of the initial program planning in May, 1976 we learned of a report on the benefits of regulation being prepared in your office. To broaden the presentation of regulation issues an inquiry was made through the Economic Research Service of USDA on the status of the report. In the absence of good information, we were under the impression that the report and research was not yet available to the public. Therefore the planning committee did not request it to be included in the program.

Since an issue has arisen about the balance of this section of the Symposium, we are particularly interested in presenting regulation research findings, both positive and negative, to the participants in the Symposium as well as others interested in the issue. Therefore, I would like to inquire if copies of the report issued November 22 by the ICC on benefits of regulation would be made available to us. If so, the Planning Committee would send them with copies of the proceeding of the Symposium to all participants. We feel since the Symposium was to present research findings, and your research report is now available, it is logical to distribute it along with the proceedings.

I would appreciate a response at your convenience. If appropriate, the Transportation Economics group of ERS, under John O. Gerald, could pick up the copies. I appreciate your consideration of this request.

Sincerely,

/s/ Kenneth L. Casavant
Chairman, Planning Committee
National Symposium on Transportation for Agriculture and Rural America

Copy of letter from Ernest R. Olson, Director, Bureau of Economics, Interstate Commerce Commission

December 14, 1976

Mr. Kenneth L. Casavant
Chairman, Planning Committee
National Symposium on Transportation for
Agriculture and Rural America
Washington State University
Pullman, WA 99163

Dear Mr. Casavant:

Thank you for your letter of December 3, 1976, indicating interest in the Bureau's "A Cost and Benefit Evaluation of Surface Transport Regulation" report issued November 23, 1976.

This "working tool" was originally developed as one of a number of cost/benefit analyses generated for the Commission's information. Some of the data derived from the study were utilized by certain Commissioners in speeches and the interest generated suggested to the Commission that publication of the study would be useful.

Whether this report might be helpful in responding to problem of "balance" can be best answered when you have reviewed it. I am, therefore, enclosing one of the last few copies of our first printing of the report. We now have a second printing in process to serve a substantial backlog of individual requests for the report.

While we are complimented that you feel it might be desirable to make the report available together with your proceedings, we will not have sufficient copies available for that purpose. However, if you feel it could be a useful document to include it in your package of material, you might give some thought to reprinting it in whole or part.

I welcome your interest in our work and especially appreciate the fact that you believe we can make a contribution to your research on transportation problems.

Sincerely,

/s/ Ernest R. Olson
Director



*U.S. GOVERNMENT PRINTING OFFICE: 1977 0-731-678/116

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Washington, D.C. 20590

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